THE

ELECTRICAL REVIEW.

VOL. L. MAY 16, 1902. No. 1,277.

CONTENTS:

	PAGE
The Liability of Trades Unions	797
Test of a 500-kw. Coupled Set for Perth (W.A.)	799
Earth Currents and the Electro-Tellurograph (*illustrated*) ...	799
Parliamentary	800
Legal	805
Correspondence:—	
The Institution and Electrical Legislation	806
The Design of Continuous Current Machines	806
Electric Wiring Methods of To-day	803
L.C.C. Specifications	807
Guernsey Telephone Accounts	807
Locating Faults in Cables	807
Sparking Trouble	803
Special Articles	808
Reviews	808
Business Notes	809
The Manufacture of Glow Lamps (*illustrated*) (*concluded*) ...	817
Model Conditions for Electrical Contracts	819
Supply Station Accounts	823
City Notes	824
Traffic Receipts	828
Stocks and Shares	828
Share List of Electrical Companies	829
Market Quotations	830
Institution of Electrical Engineers:—	
Some Notes on Polyphase Machinery (*illus.*) (*continued*)	831
Physical Society	832
Electric Traction (*continued*)	833
The Inst.E.E. and the Factories and Workshops Act, 1901 ...	834
The Britisher Abroad	835
Electrical Legislation and the Inst.E.E.	837
Light Railways and Land Development	838
New Patents	840
Expiring Patents	840
Abstracts of Published Specifications	840

THE

UNIVERSAL ELECTRICAL DIRECTORY

1902 Edition

READY.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C.

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGEEKAY, LONDON." Code, A B C.

Telephone No. 933 Holborn.

ALL Letters should be addressed to the Proprietors, H. Alabaster, Gatehouse & Co.

ADVERTISEMENT RATES ON APPLICATION.

The "Electrical Review" is the recognised medium of the Electrical Trades, AND HAS

BY FAR THE LARGEST CIRCULATION

of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES.—In Great Britain, Post Free per Year, 19s. 6d. To all other countries, per Year, £1 10s.

BINDING.—Subscribers' numbers bound, including case, for 4s. each volume.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.

READING CASES, to hold from One to Twenty-six Numbers until the volume is complete for Binding, can now be had from the Publishers, Price 6s., or Free by Post (in Great Britain), 6s. 6d.

FOREIGN AGENTS.—New York: D. VAN NOSTRAND, 23, Murray Street. Paris: VEUVE J. BOYVEAU, 22, Rue de la Banque. Berlin: ASHER & Co., 13 Unter den Linden.

Cheques and Postal Orders (on Chief Office, London), to be made payable to H. ALABASTER, 4, Ludgate Hill, E.C.

THE LIABILITY OF TRADES UNIONS.

RECENT cases which have been heard at the assizes serve to show that the new liabilities which have been imposed upon Trades Unions within the last few years are about to prove a somewhat heavy burden. Wonderful schemes have been devised for escaping the consequences of an adverse verdict; it has been proposed to sequester the funds of the Unions in such a way that no sheriff's officer shall be able to reach them. The fact that several substantial judgments have already been obtained seems to show that the advisers of the unfortunate workmen who have been victimised by the tyranny of less honourable Unions are not afraid to bring suit.

Time alone can show whether the suggested measures will prove an obstacle to litigation.

The cases which we have had an opportunity of considering have made it quite clear that the principle of the Taff Vale Railway case must not be stretched too far. In common with other bodies, Trades Unions are entitled to the benefit of that doctrine of English law which places a limit to the liability of a principal for the acts of his agent. Thus, a Trade Union can only be held responsible for those acts of the secretary which are expressly or impliedly authorised; and the Courts will not presume that the general body of a Trade Union authorises an agent to commit unlawful acts. Such a limitation to the responsibility of a Union will commend itself even to those who suffer most from the tyranny of these bodies.

A short summary of the cases recently decided may be found interesting.

Our readers will recollect that in the Taff Vale Railway case a Trade Union was defined to be a collective name for a number of persons acting for certain purposes in concert. It was also decided in that case that if such persons so acting commit a wrong, then an action can be brought, either against their representatives, or against the whole body in the name of their Union.

Mr. Justice Walton, in the course of his judgment, thus explained the result of the Taff Vale Railway case:—"A Union acts usually by its committees or officers, whose authority is defined by its rules . . . . in other words, all the members of the Union act in concert by their agent. If such combined action causes damage, and the combination is of such a character as to constitute an illegal conspiracy, the members of the Union may be made liable for such damage in an action brought against them in the name of the Union."

The result is that a Trade Union is subject to the ordinary laws of agency, and is responsible for the wrongful acts of its servants, provided that such acts are within the scope of their authority, as laid down in the bye-laws and rules of the Union.

In the majority of cases, the authority of servants and agents of the Union to do acts both lawful and unlawful on

behalf of the Union, is so clear that it is hardly worth while to raise it as a defence. Thus, in Thomas *v.* The Amalgamated Society of Carpenters and Joiners, the plaintiff was a joiner who had applied for admission as a member of the defendant Union, but owing to his having taken piece work in a non-union workshop at a time when he was short of money and had a wife and family dependent upon him, the Society refused to accept him as a member. Not content with this, they sent a demonstration to his employer, who reluctantly dismissed him. The plaintiff has subsequently been unable to obtain employment.

Mr. Justice Wills directed the jury that the real question was whether the action of the delegates was taken to promote the legitimate interests of the Society, or vindictively, to punish the plaintiff for having taken piecework. The jury found for the plaintiff, and gave him £100 damages. Although in this case it is obvious that the overt acts which occasioned the dismissal were committed by officials, yet the verdict of the jury amounted to a denunciation of the Union as a whole.

Another recent case serves to show the attitude of the British jury towards intimidation. In Banister Bros. and Moore, Limited, *v.* George Almond and Joseph Crop, president and secretary of the Blackburn Weavers' Association, the facts were shortly as follows :—

During a strike of the plaintiffs' operatives, the defendants had caused a circular to be issued in which they stated that the hands employed in plantiffs' works received an average pay of 17s. a week, and that the material served out to them was much below the average in quality. An action for libel having been commenced, they pleaded justification. At the trial it was proved that both the statements contained in the circular of the defendants were untrue; but no special damage was proved, and it was shown that the circular had not prevented fresh workmen from applying for the places vacated by the strikers. The jury found for plaintiffs, and awarded them £250 damages.

But it is not in every case that the Union can be held responsible. As has already been suggested, a question sometimes arises as to the scope of the agent's authority; for it cannot be suggested that a Trade Union, as a body, is under any greater liability for the acts of an agent than any other company or corporation.

The case of Giblan *v.* National Amalgamated Labourers' Union of Great Britain and Ireland and others, which was recently heard at Manchester, turned upon this point. There the plaintiff had been for many years a member of the Union, and had attained a position of trust therein as a local secretary. The plaintiff having failed to keep his accounts in proper order, the society and the other defendants took steps to interfere with his obtaining work. Whilst still a member of the society he was working at the Prince of Wales Dock, Swansea. His employer received notice from the defendant Williams to the effect that the men would not work with the plaintiff. In consequence of this plaintiff was discharged. He was subsequently dismissed from other places of employment for similar reasons. He then claimed damages, and the defendants pleaded that it was beyond the power of the officials to authorise or direct the acts complained of to be done.

In the course of the case it was decided to leave certain questions to the jury, who found :—(1) That both defendants, Williams and Toomey, had threatened to call out the Union men with a view to preventing the plaintiff from being employed; (2) that they did so in order that he might be induced to pay his arrears. The jury also found that these acts were done by Williams, but not by Toomey, in order to punish the plaintiff, and they awarded £100 damages. The question of the liability of the Union was reserved for further consideration.

In the course of his judgment Mr. Justice Walton said :—"I think that, for the purposes of this case, the general secretary must be deemed to have had authority to do whatever the executive committee is allowed to do by the rules. But had the general secretary any authority to call out men merely for the vindictive purpose of punishing a member who had defrauded the society and refused or failed to make good his defalcation? The jury here found that this was done by Williams, but, in doing it, he was not committing an excess or an abuse in the exercise of any authority given him by the rules—he was doing something entirely outside the limits of that authority."

Continuing, the judge held that the authority of Toomey was much more limited than that of Williams, and therefore he had no authority to make the society liable by his acts.

Röntgen Ray Burns.

Some interesting investigations on the nature and prevention of X-ray burns, by Dr. E. A. Codman, are recorded in the *Electrical World*, N.Y. From the statistics of a large number of cases occurring within the last five years, it has been estimated that one-tenth of one per cent. of the exposures have produced burns, but the percentage has very much decreased within the last year. This is considered to be due to the shortening of the length of the exposures. It is stated that the primary injury is to the nerves controlling the nutrition of the skin. The effect of the Röntgen rays on the skin, up to a certain point, seems to resemble acute "sun burning," which gives rise to blistering and destruction of the epidermis. But at this point the resemblance ceases, because the Röntgen rays occasionally extend to the deeper layers of the skin and subcutaneous tissue, even to involving the tendon-sheaths and joints. A considerable time often elapses before the burns make their appearance, the average time calculated from 70 cases being 10 days. Two methods of preventing these burns have been recommended; a thin plate of grounded aluminium may be interposed between the tube and the patient, or the exposure must be kept within a certain time limit depending on the distance of the tube. A safe length of exposure for a tube at the usual distance of 20 cm. is $2\frac{1}{2}$ minutes, and this fortunately with the modern appliances is sufficiently long for most purposes. The intensity of the rays emitted by the tube must evidently be an important factor, but no information is given on this point.

Prof. Ramsay on the Becquerel Rays.

Prof. Ramsay contributes to the *Contemporary Review* this month an article on the Becquerel rays, in which he discusses the various forms of radiations, such as cathode rays, X-rays, Becquerel rays, &c., whose investigation has recently profoundly modified our ideas of the constitution of matter. The chemists' objection to the splitting up of the atom has evidently led Prof. Ramsay astray in his representation of the conclusions arrived at by physicists in this interesting field. For example, in speaking of the cathode rays he says: "A fourth hypothesis is held by Prof. J. J. Thomson, of the Cavendish Laboratory, Cambridge. His view, which appears to be well supported by experimental evidence, is that each molecule of gas, in absorbing its electric charge, dissociates or splits up into two or more charged atoms, or groups of atoms. Such charged portions of matter have long been taken for granted as existing during the passage of an electric current through a conducting liquid, and were named by Faraday *ions* or travellers." It is evident from this quotation that Prof. Ramsay has completely misapprehended J. J. Thomson's epoch-making theory of the cathode rays. This theory does not assert that molecules of gas are split up into ions in the cathode rays, but maintains that the atoms themselves are split up, and that the corpuscles, or to adopt Fitzgerald's term, the electrons split off are only $\frac{1}{3000}$th the mass of the smallest atom. It is a matter of regret that chemists generally should misapprehend or refuse to adopt this electron theory, which has already led to so many remarkable discoveries in Physics. The Professor does indeed mention "electrons in the free state" at the end of his article, but his notion of what is meant by

this term appears to be obsolete. He says: "An electron is an electric charge which attaches itself to an atom of an element, thereby converting it into an ion." The modern "electron" has a fixed mass as well as a fixed electric charge, which is always negative, though Prof. Ramsay talks about positive electrons.

Smokeless London.

In an article in *Cassier's Magazine*, Mr. W. C. Popplewell puts in a plea for the abolition of the domestic hearth and the use of cheap gas for all domestic purposes. Such cheap gas, he seems to think, can be sent through the present gas pipes, which will have become useless owing to the universal employment of electric light. Unfortunately for this argument, however, the present pipes would be insufficient to pass the volume of cheap gas required, except at much enhanced pressures, and we fear the leakage at greater pressure would be excessive. Cheap gas is also so deadly a poison, that its regular use would require very special safeguards. Already, we believe, cheap gas, enriched, is sent out to London gas consumers. Its principal constituent is carbonic oxide, a gas which is not only a deadly poison, but of which even small quantities have powerful anæmic effects. That the use of gas would greatly reduce London smoke cannot be doubted, especially if at the same time the factory chimneys could be purified. Curiously enough, it is the electric light chimneys that are amongst the worst offenders in London, but this is to some extent due to bad engineering. What engineer of experience would deliberately lay down plant in London, which could not use the coals of Durham or Yorkshire and Notts, which are brought by sea, or the cheapest rail route? Yet there are many stations in London which must use Welsh coal or pay fines, and it is even said, that it is cheaper to pay heavy smoke fines than to pay the extra price for Welsh coal. Even Welsh "smokeless" coal will make smoke in certain kinds of furnace. The so-called practical man who sees all this concludes that chemistry and physics and all such things are mere rubbish, because he sees the exponents of these sciences ignoring the proved facts of science as soon as they approach a problem in practical engineering. London fogs are simply the result of smoke and the same silvery mist that delights our eye when seen over a Lincolnshire fen. The presence of so much water vapour stops the ascent of the smoke, and the watery particles stick to the carbon and to the tars from the domestic hearth and dissolve the sulphurous acid. Already opaque, the white mist becomes opaque blackness of an extremely filthy description. There is no reason why such a state of affairs should continue. Mr. Weir, of Glasgow, has made a boiler with a furnace constructed on the lines that have been incessantly advocated in these columns. We have seen it at work, and it is easy to see through numerous glazed sight holes into the various zones of combustion and trace exactly the effect of air supply. This boiler is not only smokeless, but it is also economical and efficient. Yet it is but the embodiment of what chemistry has taught us for years past, and what boiler makers of all persuasions have as persistently ignored in their constructions. Even when all smoke has been abolished, we shall not have abolished all the evils of the fog. There will still remain the sulphur to annoy us; the dirt will have gone. Many boilers of which the furnaces are of the correct form, but of improper material, might still be improved if their draught were better, but to employ a mechanical draught seems to be too big a step for the average electrical engineer, and we believe the only mechanical draughts in London in any electrical station were put in by men who were engineers first and electricians afterwards. Mechanical draught gives so much better command over a furnace, that it is a wonder that it is not oftener installed. It is not that a very powerful draught is wanted, but that a chimney falls short, it may be by $\frac{1}{8}$ in. or $\frac{1}{4}$ in. of water gauge. Moreover, a chimney is a wasteful and inefficient device that gives a very poor return in work for the heat expended upon it.

TEST OF A 500-KW. COUPLED SET FOR PERTH (W.A.).

The 500-kw. set, recently shipped to the Perth Gas Company (W.A.) for extensions to their electric station, was tested at the works of Messrs. Willans & Robinson in the presence of Mr. R. E. Braddock, representing the English agents, and Mr. Frank Broadbent, consulting engineer.

The set consists of a 3T. compound Willans engine, coupled to a Dick, Kerr & Co. multipolar dynamo, having a specified normal output of 450 kw., at 480 v., 270 r.p.m., with a steam pressure of 135 lbs. per sq. in. at the stop valve. An output of 500 kw. was to be obtained by the use of a bye-pass valve on the engine. The test proved that the bye-pass was unnecessary, as at the specified pressure 500 kw. was easily maintained under normal conditions. The results of the test are as follows:—

—	Steam pressure in chest.	Combined efficiency.	Lbs. of steam per I.H.P.-hour.	Lbs. of steam per kw.-hour.
Overload (500 kw.)	123 lbs. sq. in.	81·7 %	15·64	25·67
Full load (450 „)	115 „ „	81·7 „	16·1	26·4
¾ „ (340 „)	87 „ „	78 „	16 27	27·9
⅔ „ (300 „)	87 „ „	76·8 „	16·46	28·72
⅓ „ (166 „)	48 „ „	66·1 „	17·11	34 7

After six hours' run, on practically full load, the following temperatures were obtained:—

Air, 6 ft. from dynamo ...	66° F.	
Armature, engine end ...	82° F.	Rise = 16° F.
„ commutator end...	97° F.	„ = 31° F.
Magnet coils	97° F.	„ = 31° F.
Commutator	105° F.	„ = 39° F.
Core	103° F.	„ = 42° F.

Governor Test.

Volts.	Amperes.	Settled speed.	Momentary rise to	Per cent. momentary rise from 270.	Per cent. permanent rise.
480	945	270 revs.	274 revs.	1·5 %	
480	570	270 „	...	....	0
480	330	276 „	276 revs.	2·2 %	
480	0	281 „	287 revs.	6·3 %	4 %
			...	...	

The difference between the successive loads represents the amount thrown off at each stage.

EARTH CURRENTS AND THE ELECTRO-TELLUROGRAPH.

By E. Guarini.

It is well known that telegraph and telephone wires are subjected to many kinds of electrical disturbances. In the first place, there are the currents produced during storms by the charging and discharging of the conductors under the influence of the atmospheric electricity; secondly, the induction currents developed by the currents in neighbouring wires. There are also the currents due to the chemical action of the damp earth on the electrodes which establish communication with the earth, and lastly, the telluric or earth currents. These last currents pass through telegraph wires (connected at both extremities to earth) permanently, but they constantly vary in their nature, intensity and direction. Sometimes the earth currents become so intense as to render transmission impossible. The origin and nature of the earth currents are unknown, notwithstanding all that has been written on the subject, which greatly occupied the attention of the electricians who attended the Paris Congress of 1881.

The first investigations into earth currents were made by Mr. Kemp at Edinburgh (1828), and they were afterwards continued by several scientists of different nationalities. M. de la Rive attributed them to chemical actions taking place in the interior of the solid crust of the earth, the electricity being conveyed outside by evaporation.

Sabine asserted that the magnetic disturbances of the globe seemed to have a close connection with the spots on the sun, in that they are more frequent when the spots

are more numerous, and, as the magnetic disturbances of the globe are always accompanied by intense earth currents, it has been concluded that these spots constitute one of the causes producing these currents.

Exceptionally strong currents have been observed after earthquakes. Prof. Secchi observed rather strong currents, variable in their nature, for several days after storms and violent gales. A connection has been traced between the magnetic disturbances and an increase in the scintillations of the stars (Montigny, Member of the Royal Academy of Brussels).

There are many other hypotheses, and it is impossible to say which of them are correct. It is quite probable that all that we have enumerated, and all those made by other scientists, which it would take too long to enumerate, are correct, and that we must admit that these earth currents are due to many different causes, producing more or less marked effects.

Don José A. Perez del Pulgar last year made some experiments on earth currents at the Observatory of the "Colegio de Nuestra Senora del Recuerdo-Chamartin de la Rosa," in Spain, from October 16th to the 27th.

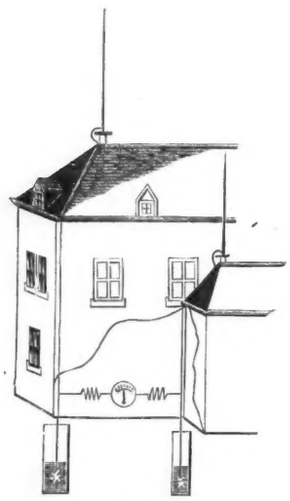
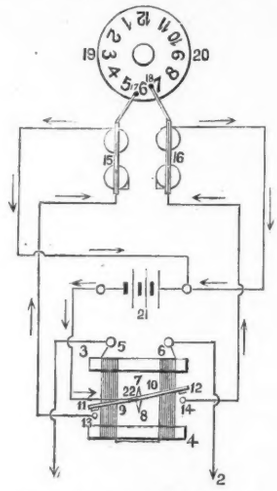


Fig. 1.

M. Perez del Pulgar used as connections to earth the extremities of two lightning conductors which protect the Observatory, and connected them to a galvanometer (fig. 1); after having made sure (by introducing a very great resistance into the circuit of the galvanometer) that no atmospheric current was passing through the galvanometer, starting from the higher lightning conductor and ending at the earth connection of the lower one (the whole of this current went almost directly to earth owing to the great resistance of the derived circuit of the galvanometer) he commenced his observations. He found:—(1) That the oscillations of the galvanometer are more frequent and more intense when there are thick clouds being carried along at a considerable speed; (2) that the variation in intensity of the sun's light seems to cause variations in the intensity of the earth currents; (3) that on damp and foggy days the needle generally points to zero; (4) that the wind very appreciably influences the intensity of earth currents, this intensity increasing in inverse proportion to the rate at which the wind travels. Notwithstanding his observations, M. Perez del Pulgar concludes that the nature and the origin of earth currents cannot yet be explained satisfactorily.

We see, therefore, what an advantage it would be to science, and perhaps to practical interests, if, by means of a simple automatic apparatus, we could make a systematic study of earth currents in order to determine the way in which they act during atmospheric and geodynamic disturbances.

An apparatus responding perfectly to these two desiderata is the electro-tellurograph which has been invented, constructed and tested by M. Lancetta (fig. 2). It consists of a very sensitive galvanometer, the coils of which are connected with two different earth connections more or less distant from one another. The relay (the galvanometer) has two contacts, and according to the direction of the earth current, works one or the other of two electro-magnets, the extremities of which, provided with a pen or pencil, inscribe upon a dial, which by means of



Description of Diagram.

Warning Apparatus.—1, 2, Connections to earth more or less distant from one another; 3, 4, Galvanometer; 5, 6, Coils of the galvanometer; 7, 8, Magnetic needle with transverse bar 9, 10; 11, 12, Platinum contacts of the bar 9, 10; 13, 14, Stops.

Registering Apparatus.—15, 16, Bells, the little hammers of which have at their extremities pencils 17, 18, which make marks on the dial 19, 20, this dial moving round by clockwork; 21, Batteries of three dry elements connected in series with the pivot 22 of the needle 7, 8, and with the bell 15 or 16, according to whether the current in the galvanometer 3, 4, is passing from 1 to 2 or from 2 to 1.

Fig. 2.

clockwork makes one revolution in 24 hours, dots or longer or shorter dashes, at different heights, so that the direction of the earth current can be easily seen. By means of the indications given by the dial, *i.e.*, the time, the duration, and the nature of the earth current, very interesting diagrams might be constructed which could be collected and compared by the central meteorological station.

The attendance (which is not arduous, as the apparatus is automatic, and there is nothing to do but adjust and change the sheet of paper on the dial) could be entrusted to the operators, who, at present, are obliged to watch the galvanometers during earthquakes and appearances of the aurora borealis.

The electro-tellurograph, which seems much simpler than other methods used for the same purpose (especially Blavier's mirror galvanometer method), could be put on circuit during the day at the hours of rest, and during the night on those lines with a limited number of hours.

It is probable that by collecting and comparing the indications obtained, we should be able to obtain definite information as to the nature and origin of the so-called earth currents, which probably do not originate in the earth at all.

PARLIAMENTARY.

Lord Windsor's Tube Committee.

On 5th inst. the resumed sitting of the Select Committee on the London Underground Railways, presided over by Lord Windsor, was held in the Grand Committee Room, Westminster Hall, to further consider the proposals contained in the Brompton and Piccadilly Circus Railways Bill.

Sir J. Wolfe Barry, the consulting engineer to the Metropolitan and District Railways, in giving evidence, said the route proposed by the Brompton and Piccadilly Circus Railway, coupled with its extension and connections, was a very good one, and would serve a better third-class neighbourhood than any of the competing or parallel schemes. On the Metropolitan and District lines he believed something like 90 per cent., or more, of the total seating capacity was third-class. The proposed route between Hammersmith and the City was as short as any of the competing schemes, and would be best calculated to serve the demand for facilities between the East and West of London. He contended that for an expenditure of something under £300,000 the

Brompton and Piccadilly Circus Company could, by constructing the junction railway to Charing Cross, give a through route to the City, instead of the expenditure of £15,000,000 or £16,000,000, which was proposed by the Piccadilly and City combined companies. When electric traction was adopted on the District Railway he thought the whole of the circumstances under which that company had previously worked would be entirely altered. The competition to be set up by the construction of the new line of the Piccadilly and City combined companies would be most disastrous not only to the District Railway but to the authori ed Brompton and Piccadilly Circus Railway, the works for which were now in progress. Nothing but the most urgent public necessity would, he believed, justify Parliament in sanctioning that competition. He felt certain that if the competing schemes were sanctioned, the competition would be so great that it must result in a poverty-stricken system of railways, all of which would be working at a loss. A further advantage of the Brompton and Piccadilly Circus scheme was that it utilised authorised capital, and was, therefore, economical. It would be a great mistake to spend an enormous number of millions upon traffic which could be dealt with by the authorised capital plus a small expenditure of new capital. The generating station at Lot's Road would be able to serve not only the District Railway but also the Brompton and Piccadilly Circus, Charing Cross, Euston and Hampstead and Baker Street and Waterloo Railways. He would admit that the sharp curves shown on the line from Piccadilly Circus to Charing Cross were unusual, but he thought that although they might lead to increased friction, they would not cause increased vibration. Lord Rayleigh's Committee, of which he was a member, found that vibration was due to two causes, viz., the weight of the locomotive engines unborne by springs, and the strength of the permanent way. The unborne spring weight should be got as low as possible, and the rails should be deep, and if these two things were carefully done, the Committee were of opinion that no vibration would ensue to give cause for complaint. He did not think in any case that the curves had anything to do with the question. Parliament had made a mistake, he thought, in sanctioning the Central London tunnel with a gauge of 11½ ft. He was in favour of a larger tunnel, so that the rolling stock of the ordinary railway companies might be interchanged.

Replying to questions, Witness said his objection to the duplication of a tube railway from Hammersmith to the City was only one of competition. There might be engineering objections as well, but he did not think they could put them very high. The reason he favoured a larger-sized tube than the Central London, was that it would give more room for the men to work at repairs, reduce the windage, and afford greater facilities for the laying of the rail 5 in. deep, instead of 3 in. or 2¾ in. The tube of the Brompton and Piccadilly Circus Railway was sufficiently large, he considered, to enable the recommendations of Lord Rayleigh's Committee to be given effect to. He was strongly against the suggested emergency platform on either side of the trains, for in his opinion, it would constitute simply another element of danger in the case of an accident. Passengers should be able to leave the train under such circumstances and walk along the floor of the tunnel.

Mr. Yerkes, who was recalled in answer to Mr. Littler, K.C., said it was not a fact that the junction between Piccadilly Circus and Charing Cross was an afterthought on his part, for it was part of the matured scheme, and it was of vital importance that the connection should be made if the District Railway was to carry the people from the Piccadilly district.

This concluded the case for the Brompton and Piccadilly Railway.

The Committee next proceeded to deal with the proposals embodied in the Central London Railway Bill, the Hon. J. D. Fitzgerald, K.C., Mr. Freeman, K.C., and Mr. H. Lloyd appearing for the company.

Mr. Fitzgerald, in opening the case, said the existing Central London line, which was six miles in length, was worked on the shuttle system, and it had been found, almost from the very commencement of the working, that, owing to the loss of time caused by the terminal shunting, it was not possible to give the larger service which was needed during the busy parts of the day. Last year the company had deposited a Bill for two loops, one at each end, the intention being to have single line loops, and to work the railway round and round without the necessity for shunting. In the report of the Joint Committee last year, it was stated that "while the advantages to the working of the line by loops are obvious, and in outside districts there can be no objection to them, the Committee think that very great caution should be exercised in sanctioning them in the heart of the City, on the ground of the large amount of space occupied, to the possible exclusion of future railways. They have less hesitation in making this recommendation, as the multiple motor system, by which much time is saved in shunting at terminal stations, appears likely to be adopted in future." The Committee also reported: "That there can be no objection to the proposed loop at the western end of the line. There is more difficulty with respect to the proposed loop at the east end of the line." The result of the consideration which the directors had given to these recommendations was the proposal that was embodied in the present Bill, which, if carried out, would make the railway a closed circuit. The proposed new line would commence at Shepherd's Bush, come down to Hammersmith, along Kensington Road, Addison Road, Kensington High Street, by the Albert Hall, and so on through Knightsbridge to Hyde Park Corner, where the line passed under the side of Green Park, thus keeping as far as possible from the houses in Piccadilly, to Piccadilly Circus. Thence across Leicester Square, down to Charing Cross, passing under the Strand and Fleet Street, it reached Ludgate Circus. A detour was then made by Thames Street to Cannon Street, and from there to St. Mary Axe, on to Liverpool Street station, and so on back to Shepherd's Bush station. Taking the whole line, therefore, practically every centre of traffic was served by it. At Liverpool Street they would also have the advantage of interchanging with the Great Eastern and North London lines. Other advantages of the present proposal were that there would be no junctions and no points, and by running the trains round and round, they would double the carrying capacity of the line. They proposed to have a single uniform fare of 2d. on the whole circuit; the system by which passengers travelling before 7.30 in the morning could have a 2d. return ticket available over the whole line, would also be continued. The advantages of the scheme, he submitted, were apparent and incontrovertible. It had been stated that if the scheme proposed were passed, the Central London Railway would have no competition; but so far from that being the case, there would be the competitive system of the Metropolitan on the one side of the Park, and the District Railway on the other. The existing tunnel was 11 ft. 6 in., and had been found amply sufficient in size for the commodious rolling stock at present in use. On the extension of the line, it was proposed to have a tunnel 12 ft. in diameter, which would be quite sufficient to give the deeper rail recommended by Lord Rayleigh's Committee. If, however, that Committee decided upon a larger tunnel being made, the promoters were quite willing to abide by that decision. He had been authorised to state that the Corporation of the City of London approved of the scheme subject to certain clauses being inserted, and that it was opposed to the North-East London Railway coming further than Cannon Street, where it wished to see a subway constructed between the North-East London and the Central London Railway. This decision had been arrived at by the Corporation after a consultation with the L.C.C. He had not been authorised to make any statement on behalf of the County Council, but he might say that the scheme had been reported upon favourably by them, and they had suggested that the company should seek Parliamentary sanction for an extension of the line from Hammersmith Broadway to Barnes, but the directors considered this suggestion altogether premature.

Sir Henry Oakley, Chairman of the Central London Railway, also gave evidence, and stated that the new capital the company was seeking under the present Bill was £3,000,000 of share capital with borrowing powers of £1,000,000.

The Committee then adjourned.

Lord Ribblesdale's Tube Committee.

On Tuesday, 6th inst., before the Select Committee presided over by Lord Ribblesdale, Mr. Ellis, secretary of the Metropolitan Railway Company, was examined at great length in opposition to the proposed extension of the line of the City and South London Railway from Islington to Euston. He contended that there was not sufficient traffic between Islington and Euston to justify the proposed extension. The Metropolitan Company, in conjunction with the District Railway, were preparing to instal electric traction over the whole of their systems, and when that was done, he believed they would be able to give an infinitely better service than the tube railways. It was only natural that the representatives of the North-Western, Great Western and Midland lines should welcome any additional facilities for their passengers.

Sir J. Wolfe Barry, consulting engineer to the Metropolitan Railway, said that if the proposed line were authorised, it would be a logical demand that the City and South London line should be linked on to the Baker Street and Waterloo line at Baker Street, and the result in that case would be to have a parallel competitive route with the Metropolitan Railway between Moorgate Street and Paddington.

The Committee announced that they had found the preamble of the Islington and Euston Bill not proved.

Mr. Balfour Browne, K.C., then opened the case for the promoters of the City and Crystal Palace Railway Bill, which seeks Parliamentary powers for the construction of a tube railway from Cannon Street to the Crystal Palace, and to take lands in Camberwell for a generating station. The proposed capital of the company was to be £3,750,000. At Penge the railway would come to the surface, and be connected with the great system of tramways which was in the hands of the British Electric Traction Company. The line would be 7 miles long, and would commence at Queen Street, close to Cannon Street, where a junction could be made with the North-East Suburban tube railway, and there would be stations at the Borough High Street, New Kent Road, Trafalgar Road, Peckham High Street, Rye Common, Dulwich Park, Lordship Lane, Sydenham and Penge. Evidence was afterwards called in support of the Bill, and the Committee adjourned.

On the resumption of the proceedings on Wednesday, 7th inst., Lord Ribblesdale made an announcement with regard to the question of vibration which would apply equally to all Bills. He said he had already foreshadowed the possibility of some covering clause dealing with the questions of vibration and subsidence being inserted in all tube railway Bills. That, he believed, had now passed out of the region of possibility and would be carried out. His Committee, and the Committee of Lord Windsor, shared the same view, and the view was also shared by Lord Morley, the Chairman of the Committees of the House of Lords. The Committee were inclined to consider the advisability of inserting a general clause giving a limit of possibly two years after the opening of the railway, during which all questions of damage arising from construction and working should be referred to a special tribunal or arbitrator. His Committee, however, reserved to themselves the right of imposing on the promoters special clauses for the pro-

tection of particular buildings. He would lay particular stress on the fact that the period of two years was only suggested as a possible basis. The exact period would have to be carefully considered, and might be argued out and altered if deemed advisable. As regarded the special tribunal, nothing was further from his mind than that questions as to damage should go before juries.

Mr. Dalrymple Hay, the engineer of the City and Crystal Palace line, said that from an engineering point of view, the scheme was a good one. It had been suggested that it was a speculative proposal, but that was certainly not the case so far as he was concerned, for all his expenses had been paid.

Mr. Galbraith, C.E., said he had considered the scheme from an engineering point of view and thought it was well laid out, and would serve a useful purpose. The estimates were based on experience in construction of similar work. Half the distance would be through London clay and through the water-bearing strata, but experience at Greenwich and elsewhere led him to anticipate that working under compressed air would dispose of all difficulty. In cross-examination, witness said he knew nothing of the financial part of the scheme. He had no knowledge of the issue of any prospectus by the company with his name appended as engineer, and was not responsible for statements in such prospectus.

Mr. Shaw said no prospectus had been issued. The document that the opposing counsel was in possession of was merely a private proof.

The Chairman observed that a name on a prospectus made the person named responsible for statements contained therein, and it seemed curious that Mr. Galbraith had not been told that the statement bearing his name had been prepared.

Mr. Galbraith said the margin allowed between capital and estimate seemed to him reasonable. It was no part of his business to raise money.

The Chairman intimated that it would be better to have some evidence regarding the financial side of the undertaking before further engineering evidence was given.

Mr. I. Gluckstein, of Salmon & Gluckstein and Lyons & Co., was called, and expressed his confidence in the financial soundness of the undertaking.

Lord R. Cecil said the fixed capital was £4,600,000, but that would be reduced by the interest for borrowing to £4,550,000. The estimated expenditure on works and lands was £2,964,041, and the equipment £653,000, which left, after certain necessary expenses, a balance of £48,860 to cover contingencies.

Mr. Emile Garcke, managing director of the British Electric Traction Company, said he thought the scheme was a valuable one, and he would advise his company to assist it financially. He had looked at the estimates of expenditure, and saw nothing improper in them. Six per cent. for expense of financing was not unreasonable, and if it could be done more cheaply care would be taken that money should not be squandered.

The Chairman: You base your opinion practically on the information given by your expert officers. What information were they given to go on?—Our engineer looked into the matter and I assume he obtained the plans, specifications, and estimates.

You do not know it?—I assume him to be a competent man, and I take it for granted that he has satisfied himself on these points.

Mr. G. Riley, of Messrs. G. Riley & Co., Lambeth, said he had subscribed £1,500 towards the expenses and Mr. J. Ritchie had subscribed £800.

Lord Robert Cecil said that about £7,000 had been actually subscribed, and the promoters had entered into agreements to subscribe another £15,000.

Mr. Burt, of Messrs. J. Mowlem & Co., said that probably his firm would take up a certain amount of capital.

The Chairman remarked that nobody in the case seemed to know anything about anybody else, and many of the witnesses seemed to be troubled with exceedingly treacherous memories.

Mr. H. H. Bartlett, of the firm of Perry & Co., contractors, said his firm had subscribed £1,000 towards the preliminary expenses, and if, as they anticipated, they obtained a portion of the contract, they would probably subscribe £50,000.

Sir C. Rivers Wilson, chairman of the British Electric Traction Company, considered that the scheme would be successful, though he spoke with some hesitation as to financial results. He considered the line would be of advantage to the system of tramways worked by his company, a system they hoped to extend largely in the neighbourhood of Croydon. He did not think there would be any difficulty in raising the capital, and if they saw their way his company would give financial assistance to the scheme.

Mr. E. Schenck, chairman of the Crystal Palace Company, said he had subscribed £1,000 towards the preliminary expenses, and he had no doubt if the scheme were passed it would give good financial results. Estimating that the line would carry 40 million passengers annually at an average fare of 2d., he calculated that the line would pay 4 per cent. He was prepared to find a portion of the capital.—The Committee then adjourned.

Electric Lighting in North London.

On Tuesday last week a Select Committee of the House of Commons, presided over by Mr. Fison, considered Electric Lighting Provisional Order (No. 1) Bill, which seeks to confirm certain provisional orders made by the Board of Trade under the Electric Lighting Acts, 1882 and 1888, relating to Edmonton, Enfield, Tottenham and Wood Green.

Mr. Baggallay, K.C., said that the Bills contained in the group before the Committee included the Bill of the North Metropolitan Electric Power Company, which company was seeking an extension of its existing powers. In the Electric Lighting Provisional Bill orders were sought by the local authorities in the case of Edmonton, Tottenham and Wood Green, while in the case of Enfield the order was sought by the North Metropolitan Electric Power Supply Company. He suggested that the Bills should be taken as competing Bills, and that evidence should be called for the Edmonton Bill and as against the North Metropolitan Bill. This course was agreed upon.

Mr. Baggallay then went into the case for the Edmonton Urban District Council, who, he said, had promoted the order in accordance with the Electric Lighting Acts. The North Metropolitan Power Company in its Bill of 1900 was empowered to supply in bulk to authorised distributors—the local authorities, tramway companies, and others—but now the company wished to supply retail. Counsel, continuing, read correspondence which had passed in July, 1900, between Mr. Morse, the solicitor of the North Metropolitan Electric Power Supply Company, and the clerk to the Edmonton District Council, in which Mr. Morse agreed to the insertion of a clause in the North Metropolitan Electric Supply Company's Bill to the effect that the company should only supply within the districts of Edmonton and Hornsey in bulk. He charged the North Metropolitan Company now with giving that agreement a direct go-by, for by Clauses 6 and 7 of the present Bill of the North Metropolitan Company, the company asked for power not only to come into Edmonton for the purpose of supply in bulk, but also for supply in retail. He contended that the proposal of the North Metropolitan Company was absolutely unprecedented, and it had only recently been set out in the case of the Northumberland and Tyneside Power Bills. In these Bills the Northumberland Company asked for powers, and stated that they had fathered a number of provisional orders. This, however, proved the strongest argument against the promoters, and it was argued that there could be no competition if both the bulk supply and the distribution were in the hands of the same company, and the result was that the Tyneside Bill, which had no such proposals, was passed, and the Northumberland Bill refused.

Evidence was then called on behalf of the Edmonton U.D.C., and the Committee adjourned.

On Wednesday Mr. Fison's Committee continued the consideration of this Bill. The Edmonton Order having been concluded, the Tottenham Order came up for consideration, and Mr. E. Neild, in addressing the Committee for the Wood Green Order, pointed out that although the company had obtained its powers in 1900, it had not yet even attempted to negotiate for a site for a generating station. The district was a very largely populated one, and there would undoubtedly be a great demand for electricity, but the inhabitants saw no prospect of getting a supply from the company in the near future.

Mr. Balfour Browne, K.C., on behalf of the North Metropolitan Electric Power Company, contended that in such a large district as that covered by the Bill—325 square miles—the fat should go with the lean, and in that way the poorer districts, who could not supply themselves, would be served by the company. They had relied upon the local authorities coming to them for their supply, but so far they had not done so, as each small borough seemed anxious to supply itself.

Evidence as to the engineering proposals of the company was given by Mr. Ferranti, who said that it was proposed to erect a large generating station at Enfield. At first they would instal plant for 8,000 kw., but it would be so constructed as to provide room for extension if it was found necessary. The total authorised capital of the company was £750,000, which was an addition of £250,000 over the capital authorised in 1900. There would be borrowing powers of £250,000, so that the total capital would be £1,000,000. He was strongly of opinion that a company like that with one large generating station would be able to supply electricity at a much cheaper rate to the local authorities than they would be able to provide it separately for themselves.

After deliberating in private, the Chairman said he had to say that the Committee had decided that they were not prepared to refuse the confirmation of the provisional orders—first, as to distribution; and secondly, as to generation. There must, however, be modifications made. That decision did not imply that the local authorities must of necessity erect their stations. The Committee agreed that it was a great mistake to have a large number of small stations. The Committee had in mind that the stations erected might be so small as to be unable to supply large manufacturing works, and they were anxious to prevent such works not being able to get a supply. They had decided that the company might not distribute without first obtaining the consent of the local authorities. If the local authorities wished to purchase in bulk they could do so, and if they wanted the company to distribute they should be able so to do. They thought that some provision might be made that the company, with the consent of the Board of Trade, might supply large consumers in cases where the local authority could not do so.

Mr. Littler, K.C., in opening the case for the Willesden portion of the North Metropolitan Electric Power Supply Company's Bill, said the company desired to have the same power of supply in Willesden as they had by their Act of 1900 in the Hendon Union. The present application had been necessitated as there had been an error of description in the Act. It was thought that Willesden was included in the Hendon Union, but at that time Willesden had been constituted a separate body in consequence of its growth.

Mr. S. Morse, solicitor of the company, supported the evidence, and said they were merely seeking for the power that had been given by Parliament in the case of Middlesbrough, where large customers had been enabled to have a supply even although they

took prospective customers from an existing concern. The company's case for this portion of the Bill then concluded.

Local evidence was then taken for the inclusion of Willesden in the Bill, when Mr. E. RUTHVEN-MURRAY, electrical engineer to the Urban District Council of Willesden, mentioned that at the present time a power house and a sub-station were being erected by the Council, the power house building being designed to accommodate 4,200 KW., and the sub-station about 3,000 KW. Contracts had been entered into for buildings, plant, mains, amounting to about £120,000. An expenditure of £143,600 had been sanctioned by the Local Government Board, which included the cost of generators with a capacity of 2,000 H.P. They could supply the tube railway if agreements could be made with the company, for their generators were constructed to supply tramways.

The Committee agreed to give the necessary power to the company to take over by agreement the authorised site in Willesden from the North-Western Railway Company, for the purpose of supplying that railway and districts surrounding Willesden, but the company was not to compete with the District Council in Willesden. The Committee then adjourned.

On Monday the Committee passed the Bill confirming the orders to the local authorities, and also passed the Bill of the North Metropolitan Electric Supply Company, subject, however, to the condition that the company should not come into the districts within three years, and then only if the local authorities have not reasonably proceeded with their obligations. The Board of Trade will be the judges as to whether the local authorities have reasonably carried out their obligations.

SCOTCH LOCAL BILLS.

ON Monday a number of Scotch Bills came before the Examiner in the House of Commons for proof of compliance with General Orders. These Bills come up under the Private Legislation Procedure (Scotland) Act of 1899, and local inquiries will be held in Scotland.

Dumbarton Corporation.—Among the powers asked for in the Bill of the Dumbarton Corporation is power to borrow money for the purposes of the Dumbarton Electric Lighting Order, 1902, in the manner provided by the Electric Lighting Acts.

Glasgow Corporation.—The Glasgow Corporation Bill, Clause 33, amends the Glasgow (Kinning Park) Electric Lighting Order, 1902, to the extent that the Corporation shall not be bound to prepare or publish an annual statement of the accounts of their electricity undertaking, so far as is situated in the burgh of Kinning Park, and the local authority of that burgh shall not be entitled to require the Corporation to sell to them, the authorised Corporation.

Leigh Burgh.—Part 2 of the Leigh Burgh Bill deals with electricity. Power is taken to supply outside authorities with electrical energy, subject to the consent of such local authorities. It also enables the Corporation to supply electric fittings, to provide and let out on hire electric motors, machinery, and apparatus for utilising electrical energy. It also fixes the date for the making up of the electric lighting accounts on May 15th in each year.

General Orders were found to have been complied with.

LONDON COUNTY COUNCIL TRAMWAYS.

A SELECT Committee of the House of Commons, presided over by Mr. Hobhouse, was occupied several days last week in considering the London County Council (Tramways and Improvements) Bill.

Mr. ERSKINE POLLOCK, K.C., in opening the case on behalf of the County Council, pointed out that of the 115 miles of tramways in the County of London, the Council already owned 75, and in another eight years the remaining lines would come into their possession. The present Bill originally included several lines which had had to be abandoned because, although the Council had made every effort to obtain the consent of the road authorities in order to prove compliance with Standing Orders, they had not been able to do so. In all there were 11 lines of tramways in the Bill, of a total length of 9 miles 1 furlong 8·25 chains. The first tramway would run from Hammersmith Broadway *vid* Queen Street, Fulham Palace Road, High Street, and Putney Bridge to the Lower Richmond Road. That was 2 miles 5·4 chains in length, and in connection with that there would have to be street widenings in Fulham and Hammersmith. There was very little opposition to the tramway, although the Hammersmith and Wandsworth local authorities were appearing in opposition. There could be no doubt as to the usefulness of the line, because it would link up with the system of the London United Tramways Company. The most important line under the Bill, and that which had evoked considerable opposition, was for a tramway service along the Victoria Embankment. It was proposed to have a double line of tramways starting from near the western end of Westminster Bridge, along the Embankment to Blackfriars Bridge. The length of the line would be 1 mile 2 furlongs 2·5 chains. The L.C.C. was the road authority for more than two-thirds of the length of the line, but there were other authorities interested in the termini. At Blackfriars Bridge there was the Corporation of London and at Westminster Bridge the Westminster City Council. He did not think there could be any question as to the suitability of the Embankment roadway to carry the tramway. It was 94 ft. wide at the Westminster end and 80 ft. wide at Blackfriars, and at its narrowest point it was 64 ft., and as the tramway would only occupy 13 ft. of the road, there could be no possible objection on the ground that the road was too narrow. There were hardly any frontagers objecting, and the complaints of the City Corporation and Westminster City Council that the tramways would inconvenience foot passengers could not, he thought, be substantiated. It was proposed to work the line by electricity on the conduit system, so that there would not be the nuisance caused in the case of horse traction. The other lines in the Bill dealt chiefly with Woolwich and Eltham and Camberwell. In the case of the Camberwell line, the proposal was to construct a tramway 2 miles 2 furlongs in length from the existing tramway at Camberwell Green *vid* Denmark Hill, Champion Park, Grove Lane, Dog Kennel Hill, Grove Vale, and Lordship Lane to its junction with Crystal Palace Road. He thought the Committee would come to the conclusion that the various tramways were for the convenience of the public, and especially that along the Embankment, which would give a much-wanted communication between the North and South of London.

Mr. FITZMAURICE, the engineer to the L.C.C., gave evidence in support of the Bill. He pointed out that in the narrowest point of the Victoria Embankment tramway there would be on each side of the lines 24 ft. of roadway, sufficient to accommodate three lines of vehicles. If the roofing of the District Railway should be damaged in any case, the County Council were prepared to pay for the reconstruction. In regard to the length of time which the County Council would require for electrifying their system, viz., seven years, he did not consider that was such a long period to effect such a change in a huge town like London. As far as the objections of the Wandsworth Borough Council were concerned, the L.C.C. were willing to assent to street widenings. Continuing his evidence in reference to the line from Westminster Bridge to Blackfriars, witness said there were no engineering difficulties to be encountered, and the line would stop short of the cross traffic. He would point out that as regarded the danger to the railway tunnels, the County Council had been running heavy steam rollers over the same ground. If arbitration proved there was any danger, the Council would share the cost of the new girders, &c.

Mr. POLLOCK said a clause would be inserted in the Bill that would satisfy the Borough of Hammersmith, and they no longer were opposed to the preamble.

In cross-examination by Mr. BLENNERHASSETT, K.C., who appeared on behalf of the Corporation of Westminster, Mr. FITZMAURICE said he could not say why the project to carry the line over Westminster Bridge had been abandoned. He felt certain there would be a very large traffic on the proposed line, but that would not increase the congestion of the traffic at either end, because the roadway was so wide. He did not think the recommendation of the Committee on Underground Railways which sat last year, that the best method of conducting passenger traffic through London would be by means of underground tramways, applied to the Embankment.—Replying to Mr. READER HARRIS for the District Railway, WITNESS said he admitted that the weight of road metal over the District Railway had been increased in recent years, but if the girders were weak from rust and age, he hardly thought the whole cost of the renewal should fall upon the promoters.

Mr. J. ALLEN BAKER, the vice-chairman of the Highways Committee of the Council, said that for many years the idea of having tramways along the Victoria Embankment had been contemplated by the Council. He did not think the proposed line would in any way disfigure the Embankment. Nearly all the leading cities of the Continent and America had trams running along public boulevards. The number of people who at present used the Embankment was no criterion of the number who would use it when a comfortable electric tramway was running along it. He did not think the tramway would depreciate the value of the property on the Embankment, and if such should be the case, it would be contrary to that experienced in other parts of the world. The proposed tramway from Theobald's Road to the Embankment which had been sanctioned would act as a feeder to the line. The tramway could be worked on the conduit system with electricity from the Council's generating station at Charing Cross. Regarding the objection raised by the District Railway, he contended that the proposed line would cater for a different class of traffic to that on the railway.—Cross-examined, WITNESS said he was not aware that in order for the tramway to pay 4 per cent. on the outlay the line would have to carry 6,500,000 passengers a year.

Mr. JOHN BURNS, M.P., gave evidence in support of the Bill, and said he took a great interest in the scheme, as affecting the working classes of Battersea. He thought the line would pay, and that it should be allowed to run over Westminster Bridge.

Mr. DEW, of the L.C.C., also tendered evidence in favour of the scheme, and said there were a great many people, both of the working class and others, who would be glad to use the line if it were constructed. He thought it would be a great advantage to have a tramway along the Embankment, to link up a communication with the shallow subway of the L.C.C. Cross-examined, WITNESS said he thought the proposal was quite fair towards the District Railway.

Asked by Mr. READER HARRIS, K.C., as to whether, if the Witness had constructed a shallow tramway at a cost of £900,000 per mile, and paid another £150,000 for wayleaves, he would consider it fair for someone else to come and run a tramway on top, WITNESS replied that he should not from his standpoint as the owner of a shallow tramway, but he thought it would be fair from the public point of view. The Committee then adjourned. (See also p. 805.)

CROYDON AND DISTRICT ELECTRIC TRAMWAYS.

A SELECT Committee of the House of Commons, presided over by Mr. Compton Rickett, for several days last week considered the Bill promoted by the British Electric Traction Company for the con-

struction of tramways in the Croydon district. The proposed tramways are divided into two sections, viz., Croydon, Sutton and Mitcham section, and the Croydon, Penge and Beckenham section. A portion of the tramways constitute what is practically a circular route from Croydon to Sutton, and thence round Mitcham Common to Croydon again. Another part of the scheme contemplates a junction with the existing tramway at South Norwood, and the construction of a line through Penge and a portion of Beckenham to Sydenham Junction Station, and also a new tramway starting at Beckenham Station, and proceeding through Beckenham and Penge to the high-level entrance of the Crystal Palace at Upper Norwood.

Mr. Balfour Browne, K.C., who appeared for the promoters, said the British Electric Traction Company were the lessees of the present lines in Croydon, and the proposed lines would join with the present system. If the Crystal Palace and City electric tube railway was authorised, it would enable the public to go from Croydon to the City by tramway and tube railway. The promoters were negotiating for the purchase of the Mitcham Light Railway Company's powers, and if these negotiations succeeded, there would be an absolutely continuous line from Mitcham to Tooting, where it would join the London County Council tramways.

Mr. Stephen Sellon, the engineer for the promoters, said the total length of the tramways proposed was 15 miles 1 furlong. A census had been made of persons travelling, which showed that there was great need of additional facilities. Witness then proceeded to deal with the width of different roads and bridges, and detailed the steps which had been taken to meet the local authorities, and the railway company.

Sir F. Edridge, Alderman of the Borough of Croydon and chairman of the Tramways Committee, said the tramways in Croydon belonged to the Corporation, and were worked by the British Electric Traction Company. He failed to see how the tramways would interfere with the railway companies, but, on the contrary, thought they would bring people to the stations. He admitted that the road on the proposed line at Carshalton was very narrow.

Similar evidence was given by other representatives from Croydon, by the chairman and ex-chairman of the Penge Urban District Council, by the solicitor of the Sutton Urban Council, and the clerk to the Croydon Rural Council, which contains the parishes of Beddington and Wallington.

The Hon. F. Thesiger, who represented the London, Brighton and South Coast Railway Company, who petitioned against the scheme, intimated that he would not press the question of competition, but there were other points of difference. The engineer of the company and the engineer of the British Electric Traction Company had consulted together and agreed on some points.

Local evidence in opposition was then heard from frontagers in Carshalton and other places.

Newcastle Tramways. — On Lord Stanmore's Committee of the House of Lords resuming on Tuesday, 29th ult., Mr. Stephen Sellon, of the B.E.T. Company, was called on behalf of the Tyneside Company with respect to the advantage of tramways having running powers over other lines. The Chairman pointed out that there was no question of running powers mentioned either in the Bill or in the company's petition, and he ruled it out of order to bring the matter forward, although they would like counsel to speak about a physical junction. Witness, in reply to questions, pointed out that it would be a great advantage both to the public and the undertakers if a through connection was established. He thought that any question which might arise as to the sufficiency of the service might be referred to the Board of Trade either on the application of the company or of the local authority. Mr. Coward, K.C., mentioned that there was a clause to that effect in the Tyneside Company's Act. Continuing, Witness considered that the power taken under the Corporation Act to charge 3d. per mile was exorbitant. He thought six months was a reasonable time for the construction of the Walker tramways. Mr. Wm. McLellan, manager to the Tyneside Tramway Company, stated that in his opinion a physical junction between the two tramway systems was essential to the public interest, and would be a benefit both to the Corporation and to the company.

Mr. Coward, K.C., addressed the Committee on behalf of the Tyneside Company, and asked the Committee to insert a facility clause providing that the Corporation should provide a proper and sufficient service of cars to meet the requirements of the public traffic upon the tramways of the Tyneside Company, and that any dispute on the matter should be referred to the Board of Trade.

Mr. Hamilton said he would not accept the clause as proposed, but stated that the Corporation would entirely accept, and desired a clause to be put in the Bill similar to that put in the Tyneside Company's Bill last year. That clause provided that if a question arose as to sufficiency of the service, it might be referred to the Board of Trade on the application of the company or the Corporation. He remarked that the Tyneside Company, in their Bill this year, were allowed five years for the completion of their tramways. It was hoped to get the Shields Road tramway completed in six months, and they would be willing to have a limit of one year put in the Bill. Turning to the question of a physical junction between the two systems, Mr. Hamilton asked what could it mean but a lever to obtain running powers, and what could it mean other than that the cars should pass over the physical junction? The Corporation were quite willing to make facilities for shelters and for exchange of traffic as might be thought proper, but they could not accept a physical junction, which could only be the thin end of the wedge for obtaining running powers.

After the Committee had deliberated in private for some time,

The Chairman announced that, so far as the Walker tramways were concerned, the Committee found the preamble of the Bill proved, subject to certain obligations being put on the Corporation. The provision that the Corporation should construct a Shields Road tramway "if they thought fit" must be deleted. The maximum fare would be 1½d. per mile. As to the time of completion, the Committee thought the Shields Road tramway should be completed within a year, and that the tramways on the lower route by the riverside should be finished within 17 months. They would exclude from the latter limit the tramroad which would have to be made under the North-Eastern Railway bridge between Walker and Wallsend. The time allowed for the completion of the whole scheme would be three years. The Committee accepted the facility clause in the form proposed by the Corporation. They also made it a condition that a covered shelter should be erected at the junction of the two systems, and that no obstacle should be put in the way of there being an ultimate physical junction of the two lines.

Evidence was then called with respect to the other portions of the tramway system proposed to be constructed, and the Committee found the preamble proved.

The objection of Mr. O'Callingham to a proposal to support wires for the tramways by means of brackets attached to houses was then gone into. The clause provided that the magistrates would fix the payments for damage done by attaching the brackets.

It was urged on behalf of the petitioner that subsequent damage might arise from vibration and other causes, and that an arbitrator and not a magistrate should decide questions of the kind. Mr. Fitzgerald Murphy, counsel for the petitioner, asked the Committee to substitute for the petty sessions tribunal, an arbitrator to be appointed by the Board of Trade. A skilled arbitrator would visit the place, and would decide on the spot whether a bracket was necessary, whether the house was strong enough to bear it, and what was to be paid as compensation. He asked that a clause should be inserted providing for payment for future damage.

At the resumption of the proceedings on Wednesday, 30th ult., the Chairman said the Committee would accept the attachment clause, subsequent to the insertion of a provision as to compensation for subsequent damage. Clauses for the protection of the gas company having been agreed upon, the preamble was passed, and the Bill ordered to be reported for third reading.

York Corporation Bill.—A Select Committee of the House of Commons considered this Bill on Tuesday last week. Amongst other things it provided that the Corporation should be empowered to purchase, construct, and work tramways. Mr. W. L. Williams, who appeared for the Corporation, said that with regard to the tramway purchase clause, the purchase had been passed by the Corporation, but was not endorsed by the subsequent ratepayers' meeting. The Corporation had entered into a provisional agreement with the York Tramways Company for the purchase of the undertaking, but as the ratepayers had refused to ratify it, the Committee would have no option but to strike out the tramway portion of the Bill. The Committee struck out the clauses.

Manchester District Telephone Board Bill.—The Chairman of Committees of the House of Lords has informed the House that the promoters do not intend to proceed further with the Bill.

Leicester Corporation Bill.—The Select Committee appointed to consider this Bill has reported that the opposition has been withdrawn, and consequently the Bill will go forward as unopposed.

Cavehill and Whitewell Tramways.—The Belfast Corporation and the National Telephone Company have deposited petitions in the Private Bill Office of the House of Lords, praying to be heard in opposition to this scheme.

Nottingham Corporation Bill.—On Tuesday the Bill of the Nottingham Corporation, which empowers the Corporation to construct additional tramways, &c., was before Earl Morley's Committee of the House of Lords on Unopposed Bills, and was ordered to be reported to the House for third reading.

Manchester and Liverpool Electric Express Bill.—This Bill, which authorises the company to make a deviation of the line at Salford, was on Tuesday before Earl Morley's House of Lords Committee on Unopposed Bills, and the preamble having been formally proved, the Bill was ordered to go forward.

North Staffordshire Tramways.—Under this Bill the North Staffordshire Tramways Company are enpowered to work their tramways by electric traction, and it confers further powers on the Potteries Electric Traction Company. The Bill came as an unopposed measure before Earl Morley on Tuesday, and was ordered to be reported to the House.

Wrexham Tramways.—On Thursday of last week Lord Glenesk presided over a Select Committee of the House of Lords which had under consideration the Bill of the Wrexham District Tramways Company (Extension). Under the Bill the company seek power to construct new tramways and other works, and to work the tramways by electricity. The company are the owners of the tramways authorised by the Wrexham District Tramways Act of 1873, and have agreed to purchase the tramways authorised by the Wrexham District Tramways Order, 1899. The tramways to be constructed are in the parish of Rhosllanerchrugog, in Denbigh. With regard to purchase by the local authorities, it is asked that Section 43 of the Tramways Act of 1870 shall, in its application to the undertaking, be modified by the period of 42 years being substituted for 21 years, and the terms upon which the company may be required to sell the undertaking shall be the terms of paying the fair market value thereof as a going concern, but without any allowance for compulsory purchase. The only opponents to the scheme were the Great Western Railway, which has a branch line between Rhosllanerchrugog and Rhos, which was built a few years ago at the express desire of the inhabitants of Rhos at a cost of £40,000. The tramway company is now in the hands of the British Electric

Traction Company. After hearing evidence for and against the Bill, the Committee found the preamble proved.

The Wrexham Corporation have deposited a petition in the Private Bill Office of the House of Lords in favour of the Wrexham District Tramway Bill.

Middlesex County Council Tramways.—On the resumption of the proceedings on Tuesday last week, Mr. FREEMAN, K.C., submitted the case of the Heston and Isleworth District Council, and pointed out that what was proposed by the Bill was a very serious matter for the local authorities, as it might create a precedent having far-reaching consequences. The proposal was really to alter the existing law in favour of one County Council. By the Tramways Act of 1870, the various local boards in Middlesex were the authorities to deal with tramway matters, but the Middlesex County Council wished to come in as a second authority to deal with identically the same matters. He urged that if any such change was to be made it ought to be done by way of a general Act and not by a private Bill. After hearing evidence in support of Mr. Freeman's case the Committee consulted in private, and on the proceedings being resumed the chairman announced that the Committee found the preamble proved. The Committee, however, wished it to be made quite clear that if the County Council purchased a tramway, it was not intended for the local authority to have the option of purchase after a term of years. At the same time, if the County Council purchased any tramway before the expiration of 21 years by agreement, they would be bound by any obligation the District Council had entered into.

Northumberland Electric Tramways.—On Tuesday, 6th inst., the Northumberland Electric Tramways Bill came before Earl Morley, chairman of the Unopposed Committee of the House of Lords. Evidence was given that the preamble was true, and the Bill was ordered to be reported for third reading. The Bill authorises the Northern Counties Electric Supply Company, Limited, to construct about 15 miles of tramways in Northumberland to connect Morpeth, Bedlington, Bebside, Blyth, Ashington, and Newbiggin.

Newcastle-upon-Tyne Electric Supply Company.—On Tuesday, 6th inst., the above Bill was before Earl Morley in the House of Lords as an unopposed measure, and the necessary proofs being forthcoming, the preamble was declared proved and the Bill ordered to be reported for third reading. The Bill extends the powers of the company with regard to the supply of electricity in bulk to authorised distributors.

Huddersfield Corporation.—A Select Committee of the House of Commons, under the chairmanship of Mr. Haywood Johnstone, on 7th, 8th and 9th inst., considered the Huddersfield Corporation Bill. Amongst the powers sought are those to enable the Corporation to supply electricity where a consumer is separately supplied; to refuse supply of electricity in certain cases; to supply electric fittings, &c. The electrical clauses were not opposed.

Electric Lighting Orders, No. 4 Bill.—The above Bill came before the Chairman of Ways and Means of the House of Commons on 8th inst. as an unopposed measure, and was ordered to be reported for third reading. The Bill confirms Board of Trade orders in regard to Aberdare, Amble, Dover, Frinton-on-Sea, Gillingham, Hindhead and district, Leadgate, Leatherhead and district, Paignton and Stanley. Full particulars of the Bill appeared in the ELECTRICAL REVIEW of May 2nd.

Standing Order Proofs.—It has been reported that the Standing Orders of the House of Lords have been complied with in respect to the following Bills:—South Wales Electrical Power Distribution, Cavehill and Whitewell Tramways, Salford Corporation, and Dartford Improvement.

Rossendale Valley Tramways.—This Bill should have been before a Select Committee of the House of Lords last week, but all opposition having been withdrawn, it will go before the Unopposed Committee. On Tuesday the Bill came before Lord Morley, chairman of the Unopposed Committee, and was reported for third reading.

Electric Lighting Provisional Order, No. 6.—The Lancashire County Council have petitioned to be heard in opposition to the Lees Order contained in the above Bill.

LONDON COUNTY COUNCIL TRAMWAYS.

(*Continued from page* 803.)

ON Monday the Select Committee of the House of Commons, presided over by Mr. H. Hobhouse, further considered the L.C.C. (Tramways and Improvements) Bill.

Sir J. WOLFE BARRY, the consulting engineer to the Metropolitan Railway Company, said that for 1¼ miles the proposed Embankment tramway would follow the course of the District Railway. It was proposed to run the tramway for about 740 yards immediately over the railway tunnels. The tunnels, which had been constructed 30 years ago, he contended, were at the present time very highly strained, and he looked with extreme anxiety to the extra weight which would be put upon them by the rolling cars. From examination he knew the girders were subjected at the present time to heavier strain than they really ought to receive, and the proposed tramway would necessitate the reconstruction of the tunnels. That would be a very dangerous and expensive undertaking. Giving a rough estimate, the work would add 50 per cent. to the promoters' estimate of £40,000. The cost of an alternative method of connecting the northern and southern tramway systems by a tube under the river from the Strand to the neighbourhood of Waterloo Bridge Road, he should say, would be about £103,000. He should say that without connections at either end of the Embankment no great traffic could be expected. On the electrification of the District Railway, trains would be able to run on the line at one-and-a-half-minute intervals at a speed of 16 miles an hour.

Mr. BLENNERHASSETT, K.C., appearing on behalf of the Westminster Corporation, gave it as his opinion that two rigid lines along which travelled 20 huge cars would completely destroy the Embankment as a means of quick access to and from the City and would disfigure the thoroughfare. In view of the many proposed underground railway schemes now before Parliament, he thought it would be premature to sanction that fragment of a scheme.

Sir F. DIXON HARTLAND, M.P., gave similar evidence in opposition to the scheme.

Mr. LITTLER, K.C., on behalf of the Corporation of London, asked their Lordships not to pass the Bill on the ground that the tramway along the Embankment would prove a great obstruction to traffic. The Committee adjourned.

(The tramway has since been authorised between Westminster and Waterloo Bridges.)

LEGAL.

IN *re* WORKMEN'S COMPENSATION ACT, 1897, ASHTON *v.* CALLENDER'S CABLE AND CONSTRUCTION COMPANY, LIMITED.

THIS case came before the Court of Appeal, composed of Lords Justices Romer and Mathew, on Thursday on the application of the company to discuss the plaintiff's appeal on the ground that the plaintiff had failed to give security in the sum of £15 in pursuance of an order made by this Court on November 25th last. The application was granted.

F. TALBOT *v.* NATIONAL TELEPHONE COMPANY.

BEFORE his honour Judge the Hon. A. Russell at Reading County Court on the 6th inst., Mr. F. Talbot, contractor, of Caversham, sued the National Telephone Company for £47 for work done in connection with the laying of underground cables at Caversham. The company counterclaimed £89, being £50 damages paid to a Mr. Hanson for injuries he received by falling over a projecting manhole, and solicitor's costs, it being alleged that the accident was the result of the plaintiff's negligence. After hearing the evidence of both sides, the jury found for the defendants for the sum of £42, the difference between the two claims.

MARSH *v.* CHARING CROSS AND CITY ELECTRIC COMPANY.

IN the Westminster County Court on Monday, his Honour Judge Woodfall and a jury tried this action. It was a claim for damages of personal injuries under the Employers' Liability Act.

Counsel for the plaintiff said that on October 9th last, Marsh, who was in the employ of the company, was sent to work at a manhole in Ludgate Hill, where, after he had been at work for some little time, an explosion occurred, and seriously injured him and a fellow-workman named Lewin. The accident was so serious that plaintiff was kept out of his employment until January, when he returned to the company. Before the accident he was a jointer and wirer, but his injuries prevented his acting as a jointer, owing to the mischief caused to his nerves, and his average weekly wage earnings had dropped from £2 5s. to £1 18s. His clothes were spoilt, and there were the pain, suffering, &c. The accident was caused (counsel went on to say) through defects in the plant. The cables and connectors were filled in with bitumen, and on the top of that was a layer of resin-oil which appeared to have had the effect of softening the bitumen so that it did not serve the purpose for which it was intended, *i.e.*, to keep the cables in position. The result was that when a screw was being fixed there was a connection which brought about a "short circuit." Since the accident, means had been adopted which would prevent the recurrence of such an accident.

Plaintiff, 20 years of age, gave evidence in support of counsel's opening.

Cross-examined: Witness could not dispute that there were over 400 boxes similar to that where the accident occurred; nor that his was the only accident of that kind that had occurred. He knew that a box in Paternoster Row burst on the Sunday following, and a few days later, one in Poultry. Witness was positive that when he started work no connection between the two cables existed. Witness did not use a pick-shaft to force one of the cables into a certain position.

Mr. LEWIN, plaintiff's fellow-workman, who was also burnt, said his claim had been settled by the company, who, in paying him £60 10s., disavowed all legal liability, and added that the sum was being paid in consideration of witness's long service.

Mr. CHAS. WEST, M.R.C.S., L.R.C.P., of St Bartholomew's Hospital, said he saw plaintiff when he was brought to the hospital. It was a severe case of burning. His face, ears, hands and wrists were all seriously injured, parts being actually charred. He also suffered from shock. He was delirious for some days, but left early in November. Skin was transferred to parts of his face. He suffered great pain.

Eventually his Honour, after hearing counsel, decided in favour of the defendants on the ground that no negligence had been established. The case did not go to the jury, and plaintiff was non-suited.

HITCHIN & BOOTH *v.* EHRENFELDT.

AT Westminster County Court on Tuesday, his Honour Judge Woodfall had before him the above action, which was a claim for £10 10s., being a "nominal" charge for a report prepared by the plaintiffs on a certain projected tramway.

Mr. HUBERT BOOTH said he was a member of the plaintiff firm, carrying on business as consulting electrical engineers in Victoria Street, S.W. On December 6th, 1901, the firm was approached by Mr. Ehrenfeldt with regard to the preparation of a report on a proposed tramway, 5 miles in length, on the system patented by a Mr. Cook. Witness agreed that his firm should do this for a nominal fee, in consideration of Mr. Ehrenfeldt's promise to get the firm appointed consulting engineers if the prospective contract for laying down the tramways in question were obtained. The so-called "report" was really an estimate for the electrical equipment of these tramways, and was prepared so that it satisfied the local authorities. Throughout witness dealt with Mr. Ehrenfeldt. Witness had to call in Messrs. Buchanan to consult in connection with certain points, and the 10 guineas was merely a nominal charge, considering the amount of work done. Had witness been making a charge in the ordinary way, the charge would have been 25 guineas.

Cross-examined: WITNESS was introduced to defendant by a Mr. Hale, who was tendering for the metal work of the proposed contract. Witness saw Mr. Cook, the patentee of "Cook's Patent Tramways System," but did no business with him.

COUNSEL: You describe yourselves as electrical engineers?—Yes.

But you are not experts?—I don't know what you mean.

You had to call in another firm for the technical points?—No.

Continuing, WITNESS said that had Cook's system been adopted, his (witness's) firm would have been entitled to a large commission—probably 2½ or 3 per cent.

By his HONOUR: Witness knew Cook only as patentee of the system, and imagined that Mr. Ehrenfeldt was a promoter of Cook's Patent Tramways, Limited, who was dealing with some Corporation; what one, witness could not say. Witness did not notice that Mr. Ehrenfeldt signed himself "M. Ehrenfeldt, Secretary."

Mr. CHAS. HITCHIN gave confirmatory evidence. He did not notice the signature either.

Mr. MAURICE EHRENFELDT, the defendant, said he was an auditor in an office in Fletcher Street, City. He was secretary of the Cook Company, and always dealt with plaintiffs in that capacity; he certainly never made himself personally responsible.

Cross-examined: Witness was the secretary of several companies. The Cook Company was incorporated in March, 1901, with a capital of £5,000, none of which was paid up. The company had no assets, but witness did not tell plaintiffs this. Except in the letter mentioned, witness wrote in the first person singular. Plaintiffs did their work on a usual understanding—a big fee if the contracts were accepted, and merely a guinea or so if not.

Eventually his HONOUR found in favour of the defendant on the grounds (1) that the word "secretary" should have set the plaintiffs on inquiry; and (2) that the fee claimed was not a nominal one.—Judgment accordingly.

CORRESPONDENCE.

The Institution and Electrical Legislation.

Mr. Raworth's letter in your last issue opens the way to a discussion of this important subject in your columns. Probably there is no question which at the present time is deserving of more thorough ventilation, for the era of power distribution on a scale of such magnitude as to influence the industrial future of this country is upon us, and the speed and effectiveness of its advent turn upon the attitude of Parliament towards the reform of electrical legislation.

It is a humiliating outcome of the spirit which has dominated the Legislature towards industrial developments for the last half century that we should to-day be largely dependent upon foreign capital and foreign plant for the introduction of large electrical works, requiring courage and enterprise, into Great Britain, the country which, less than a century ago, prided itself upon the possession of those qualities in a greater degree than any other of the world's communities.

The culmination of the report of the Institution lies in the proposal to bring the facts directly under the notice of Lord Salisbury, as Prime Minister, and therefore the source from which remedial legislation can flow. It is not too much to say that the responsibility resting on the shoulders of the Government to form a right judgment in this matter is one from which it cannot lightly escape; for such action or inaction as follows upon its appreciation of the gravity of the issue will determine for good or evil the course of what is likely to be, in its social and industrial consequences during the next half century, the most far-reaching industrial development which this country has yet experienced.

There are not wanting indications that the public, at any rate, are awakening to a realisation of the position. The difficulty lies in the congested state in which much-needed legislation finds itself under the ill-adapted centralised system by which such matters are controlled among us, and in the consequent reluctance of Governments to add to the accumulation of subjects with which they are pressed from all sides to deal. It is only by impressing the Ministry for the time being with the relative importance of some specific question over others of less urgency that precedence can be secured for it. Hence the necessity for a widespread consensus of opinion as to the need of reform in legislation and State-departmental methods and action in the field of electrical development; and it is much to be desired that the Press generally will continue to lay stress on the urgency of such reform until relief is obtained.

R. Percy Sellon.

The Design of Continuous Current Machines.

In your issue of April 25th, Mr. Hindle makes some very interesting remarks on continuous current dynamos, and attempts to obtain a general formula applicable to their design. After making some very reasonable assumptions as to flux density in pole pieces and roots of teeth, and assuming a peripheral speed in terms of armature diameter, &c., Mr. Hindle gets out his first factor :—

$$\text{Total flux} = \frac{\cdot 025\ D^2}{100}.$$

This appears to fairly represent modern practice, even with larger machines than he states it is applicable to.

Presumably Mr. Hindle was considering only bi-polar machines, but, on trial, I find that if one corrects for the number of poles, this factor still fairly represents average practice.

The next factor, $\frac{D^2}{6}$, as representing the total gross area of slots, is about right, taking Mr. Hindle at his word, when he says that this value is excessive when applied to large modern machines, for, in the case of a large traction generator, against which I have tested this factor, the total gross area comes out about equal to D^2, assuming D = diam. of armature in inches. But I have not failed to observe that Mr. Hindle's approximations are intended to apply to much smaller machines.

But coming to the two remaining factors :—

$$\text{Space factor} = \frac{\sqrt{D}}{12},$$

$$\text{and current density factor} = \frac{10{,}000}{\sqrt{D}},$$

I confess I am much puzzled, for I certainly was not aware that the "space factor," representing the ratio of the total cross-sectional area of copper in a slot, to the cross-sectional area of the slot itself, had any direct connection with the armature diameter.

The space factor is principally dependent upon the thickness of insulation required, and consequently is pre-eminently a function of the *voltage* of the machine.

Trying to establish a relation between the current density and diameter of armature, also, appears very puzzling and subject to the same criticism as the space factor.

With these two exceptions, Mr. Hindle's attempt appears to be admirable, and no doubt Mr. Hindle will explain these seeming anomalies in his promised article in the *Practical Engineer*.

Fielder J. Hiss.

Electric Wiring Methods of To-day.

I gather from Mr. Joy's letter that he suggests a new departure to enable him to bend "split" or "open seam" tube—viz., by a heating process, which would certainly destroy the enamel, and cause the tube to deteriorate when buried in plaster or cement.

With a good welded tube a practical man is able to make any angle or bend required, in a very short time without any accessories.

I note that Mr. Joy is not aware that "insulated tube

ends" are screwed on all welded tubes behind switchboards, &c., where the edges would otherwise be devoid of insulating material.

Judging by the tone of Mr. Joy's letter, I should certainly think that his experience of complete draw-in conduit systems is somewhat limited.

M. E. Heaton.

Newport, Mon., *May 10th*, 1902.

L.C.C. Specifications.

Herewith I enclose you copy of correspondence with the London County Council, which will probably be of interest to the electrical world.

W. Davenport,
Secretary, The National Electrical Manufacturers' Association.

London, *May 7th*, 1902.

April 16th, 1902.

G. Gomme, Esq.,
Clerk of the London County Council,
Spring Gardens, S.W.

Dear Sir,—Your letter of January 9th last, asking for tenders for electric lamps, together with your specification for same, is before me. In this specification you stipulate that the lamps shall be of English make, and you further bind those who tender to certain labour requirements which can only apply to goods made in this country.

We are informed that you have accepted the tender of the Brush Electrical Engineering Company, whose lamp works are in Vienna.

I am instructed to draw your attention to this, and to ask your assurance that English-made lamps only will be accepted.—Yours faithfully,

(Signed) W. Davenport,
Secretary, The National Electrical Manufacturers' Association.

County Hall, Spring Gardens, S.W.
April 23rd, 1902.

Sir,—I am directed to thank you for your letter of the 16th inst., and to say that the Council were aware that the lamps supplied by the Brush Electrical Engineering Company would be foreign-made. On the next occasion of inviting tenders for electric lamps, firms will be asked to send in two quotations, one for English-made lamps and the other for foreign-made lamps.—I am, Sir,

Your obedient Servant,
(Signed) G. Gomme,
Clerk of the Council.

The Secretary of the
National Electrical Manufacturers' Association.

Guernsey Telephone Accounts.

The accounts of the Guernsey telephone system, which have been published far and wide, are highly interesting. But might I ask an explanation as to how the 43 employés set out in the schedule are paid?

The following seems to be the basis, as far as I can interpret the accounts :—

Expenses of management £55 5s. 5d., including salaries of manager and engineer ; or, say, £26 each per annum.

Operators' salaries £405 5s. 11d., among eighteen operators ; or £22 10s. 4d. each per annum.

Office salaries £128 17s. 6d., among two clerks and six inspectors ; or £16 2s. 3d. each per annum.

I exclude linesmen and labourers (13) and the two foremen, who are, it is to be presumed, chiefly on new installation work, and paid from capital account (save for such wages as are included in "repairs") ; but it certainly seems that Guernsey must be an excellent place to get away from, if the above represents standard rates of pay for competent officials.

Not a Channel-Islander.

Locating Faults in Cables.

I have a suggestion to make upon the subject of "cable testing," on which I shall be pleased to have the opinion of persons interested in this work. It is chiefly in connection with armoured lead-covered mains, distributors, feeders or service cables. In the first place, consider a three-wire solid system distributor with armoured and lead-covered service cables, either concentric, triple or single ; it is much more reasonable for the fault to exist in the service (cables or cable), and it is in nine cases out of ten that the lead is partially insulated from earth. Now suppose a pick or other instrument damages the armour and lead, it is certain that the lead will then become live at or nearly at the same potential as the damaged cable. Assuming 20 or 50 such services in connection with the distributor, it would be a difficult matter to disconnect every service and find the fault. I have tried the following :—After examination of the service connections and disconnection of consumers' wiring, you

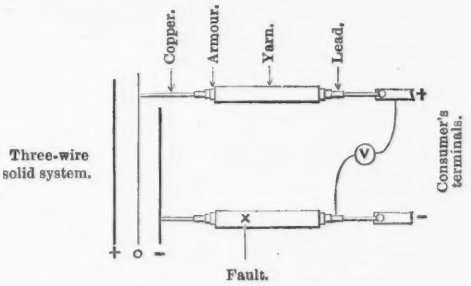


Fig. 1.—Three-Wire Solid System with Lead-Covered Services. Pressure, 460 volts between outers.

test the faulty cable to the lead as shown on sketch. A fault occurs at F on the negative cable, you earth the positive or neutral at works, and then test every consumer's service from inside each building until you come to the faulty one ; if no service is faulty it is then in the distributor, which is tested by the ordinary methods. I think you will be able to see clearly what the method is. The fault being at F on the negative, the *lead* is sure to be the same potential as negative ; you then take a suitable voltmeter and test at each service from the neutral or positive cable to the *lead* of the negative or whichever the fault is on.

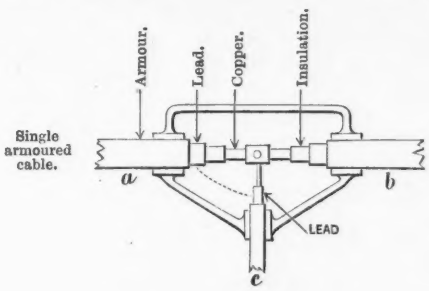


Fig. 2.

The same to be done to the other cable or cables entering a building according to the system, two or three-wire.

If you test from the positive to a service cable which is good, you obtain no deflection, but when you touch the faulty cable you obtain deflection according to resistance of fault, and I have personally found out the fault out of 34 consumers connected to distributors. Also the test is more useful when dealing with armoured lead-covered mains.

Sketch 2 :—*a* and *b* is an armoured distributor with a tapping for service *c*. At every joint box attach a wire as shown inside every joint box from *a* to *c* on the lead only, but not touching the box or *b*. The idea is to test from inside *c*, service house, whence you can test right up to the next service box ; then do the same as before. Suppose a fault occurs in a network, locate distributor, then try every service as before, and you could locate the fault between two consumers ; also with lead-covered mains run solid in troughs or conduit, you could do exactly the same but *not* where lead *wiped joint* boxes are used, because the continuity of the lead affects the idea.

I shall be pleased to hear your view of this arrangement and if it has been tried before.

E. F. Cox.

Wolverhampton, *May 6th*, 1902.

Sparking Trouble.

I am engaged on a piece of work (a magnet actuating a brake) that has a rocking make-and-break contact, with very little travel, so the contact is not a good one. The magnet is wound for 100 volts, and works off an electric light installation.

If I should be grateful to learn what I can do to reduce to a minimum the sparking—are there any recent books dealing with the subject?

Student.

SPECIAL ARTICLES.

When Oliver Goldsmith sought to satirise some of the men and manners of his time he invented a Chinese philosopher, called him Lien Chi Altangi, and in the guise of correspondence to Eastern friends wrote a series of essays including such subjects as "The Degeneracy of some of the English Nobility," and a "Description of a Club of Authors." During the course of a libel action, Cowen *v.* Labouchere, just concluded by the disagreement of the jury, some indication was given that a real Chinese philosopher was likely to publish his experiences in this country. By all account Lo Fen Gluh, the Chinese Ambassador to the Court of St. James's, is a man of much learning and keen perception. We hope no impediment may be placed in the way of his giving to the Western world a full account of his experiences and his impressions. We ought to know what he thinks of our mandarins, and he might be persuaded to give some "Description of a Club of Articles," with particulars of the process whereby a definite article becomes an indefinite article, and the area for membership thereby indefinitely increased. As a student we do not doubt so learned a man as Lo Fen Gluh knows that in the science and art of advertising it is an axiom that a publication which is distributed gratuitously is usually without value as an advertising medium. We hope Lo Fen Gluh may be persuaded to tell us how it is that so many of his Western friends were not cognisant of such a fact. But the main feature of the journal of the Chinese philosopher should be an account of the almost regal progress of his renowned fellow countryman to the centres of industry, with a statistical statement of the results to commerce in general and *Commerce* in particular. We repeat our hope that nothing may hinder such a publication. There should be in it some most useful lessons.

REVIEWS.

An Elementary Treatise on Alternating Currents. By W. G. Rhodes, M.Sc. London: Longmans, Green & Co. 1902.

The author gives a fairly complete survey of the mathematical theory of single and polyphase alternating currents. He treats of "root-mean-square" values, vector algebra, power measurement, transformers, converters, and all the various kinds of motors. Naturally the treatment is at times of a very sketchy character, but the beginner can easily supplement what is given by information from other sources. This book is an excellent introduction to the subject, and will enable the intelligent student to understand the works of Steinmetz, and the more advanced papers on the theory of alternating currents, without much difficulty. It is written for "practical engineers, university honours students, and the more advanced students in technical schools." A slight acquaintance with the calculus, and familiarity with algebra and trigonometry, are pre-supposed.

Mr. Rhodes begins by assuming sine curves of P.D. and current, as by their means the beginner gets a general notion of what happens in an alternating current circuit. We think, however, that he pushes the sine curve theory a little too far. His reasoning about the "equivalent sine curve" is not convincing. It is doubtless possible to "calculate the effects of hysteresis and eddy currents" on the assumption of equivalent sine curves, but the formulæ are only rough approximations. For example, in the formula for eddy currents given on p. 103, it appears that the loss due to eddy currents is proportional to the square of the maximum induction density, yet the more correct formula given two pages further on shows that it varies as the square of the applied voltage.

On p. 16 we are led to infer that the coefficients of induction in coils containing iron are approximately constant so long as the induction in the iron does not approach saturation. The permeability of iron, however, is only constant for very minute magnetising forces, and hence the assumption that there are coefficients of induction in ordinary alternate current apparatus is a large one. The difficulty might be got over by considering "equivalent inductances" or something of that nature, but then, of course, the book would be getting too advanced for beginners. Perhaps also this is the reason why the theory of the power factor is hardly touched upon, and the old puzzle about "lag" and "lead" not cleared up.

The chapter on vector algebra is a very good one, and Rayleigh's solution of the problem of mutually reactive circuits in parallel follows easily from it. This is the fashionable method of treating alternating current problems in America and on the Continent, and no electrician can afford to be ignorant of it. There is something very attractive about $\sqrt{-1}$, but, like the method of duality, its use has been much overrated. It has to be remembered that, after all, it is only strictly applicable to sine curves.

We were disappointed with the author's omissions in the theory of the transformer. From an historical point of view his treatment is interesting, and he shows that Maxwell's equations can be got very simply, but there are no formulæ given for the connection between the ampere-turns on the primary and secondary, or even for the secondary voltage. These could have been easily proved, and it seems to us that beginners would appreciate working out examples on them. The formula given for the efficiency is a very quaint one, and is decidedly more complicated than the following, which is true for any commercial transformer:—

$$\eta = \left(1 - \frac{W_0}{W_1}\right)\left(1 - \frac{Q\,W_1}{V_1^2}\right),$$

where η is the efficiency when the primary load is W_1, W_0 the primary watts on open secondary circuit, V_1 the primary volts, and $Q = R + \frac{S}{n^2}$ where R and S are the resistances of the primary and secondary coils, and n is the ratio of the secondary to the primary turns.

We doubt whether the ordinary reader will understand the characteristic curves given for synchronous motors. We think that it would have been better if the parts of the curves corresponding to possible but unstable positions of equilibrium were dotted. We should have liked a fuller treatment of the induction motor; the little that has been given is well done. In the methods of measuring power given, the electrostatic wattmeter has been omitted. The resonance method might also have been given with advantage, but in our opinion the electrostatic wattmeter is the most suitable for measuring very low power factors. In the Appendices Mr. Rhodes gives some neat mathematical solutions. We were especially pleased with his treatment of the problem of "n" mutually reactive circuits in parallel.

Those electricians who wish to improve their mathematical knowledge of the subject would do well to read this work. They will then be no longer troubled about such subjects as the ratio of transformation of rotary converters, and we hope that they will cease to multiply their wattmeter readings on three-phase circuits by $\sqrt{3}$.

The Elements of Physical Chemistry. By Harry C. Jones, Associate Professor of Physical Chemistry in the Johns Hopkins University. New York: The Macmillan Company. London: Macmillan & Co., Limited. 1902. Price, 17s. 1d. net.

There can be no doubt that physical chemistry is a most important branch of science, and one which has been greatly neglected in the past, if, indeed, it is not somewhat so still. The position of affairs relating to it is rather peculiar, because

although there has been a recognised chemical side to physics since the earliest days of that science, until within the last 15 years or so, the physical side of chemistry has been ignored. In other words, while our physicists, even the patriarchs and pioneers, were keenly alive to the necessity of studying elementary chemistry, recording experiments and formulating theories on the borderland of the two sciences, their chemical brethren left this fruitful field severely alone, and limited their studies to the behaviour of atoms rather than of molecules. And until quite recently physical chemistry has also had to struggle for recognition for a totally different reason. Many of our chemists look somewhat contemptuously upon the inorganic branch of the science, alleging, in deed if not in word, that inorganic chemistry is worked out; so that professors and students coquet with closed chains and substances with impossible names, until the cynic may be forgiven for defining chemistry as a study of carbon compounds alone. Fortunately there are signs nowadays of a reaction: electro-chemistry and electro-metallurgy have become so important that their claims to investigation can no longer be put aside; the benzene ring has been found not to inclose the sum of human knowledge, and the mysterious laws of thermo-chemistry and electrolysis have at length asserted their right to attention. On the other hand, a vast amount of good work has been done by a small number of physical chemists during the past two decades, work which is still scattered over many journals, and which is therefore inaccessible to the ordinary student, and apt to be forgotten or overlooked by him.

In such circumstances as these, a volume which contains within its covers a summary of the investigations made by the older physicists as well as an account of those instituted by the later physical chemists cannot be other than welcome; and when, as in the book before us, that work is described lucidly, in reasonably clear language, and with clarity and precision, we can only thank the author for having helped to fill a distinct want. Mr. Jones's volume contains chapters on atoms and molecules, gases, liquids, solids, solutions, thermo-chemistry, electro-chemistry, photo-chemistry, chemical dynamics and equilibrium, and measurements of chemical activity. The portions of the book dealing with solutions and electro-chemistry can be safely commended: our author does not exactly make the subject of ions intelligible, but he bravely strives, and with some measure of success, to render it less unintelligible than it usually is. His chapter on thermo-chemistry is brief, for he says, "This subject has never acquired that prominence which for a long time it seemed likely to attain, partly because the data are often so complex that it is difficult to interpret them and discover their meaning." That, no doubt, is "partly" true; but if more investigators would take up this branch of science and work it systematically, the results would well repay their labours, and would ultimately yield matter of the highest value to the pure man of science and to the industrialist alike.

We have read Mr. Jones's volume with considerable profit and pleasure, not a little of the latter being due to the commendable absence of those Americanisms which often irritate the student on this side of the Atlantic, who still has some respect for the beautiful language which has been handed down to us through the centuries, but which is sometimes made almost incomprehensible to the effete Britisher by the curiosities of diction invented by the journalist of the States.

BUSINESS NOTES.

Books Received.—"Congrès International d'Electricité, Paris, 18—25 Aout, 1900." Rapports et Procès-Verbaux publiés, par les soins de M. E. Hospitalier. Paris: Gauthier-Villars, 1901.

"Twenty-seventh Annual Report of the Yorkshire College, Leeds, 1900-01." Leeds: The Yorkshire College.

Polyphase Machinery Contracts. — The British Schuckert Electric Company, Limited, have received recently several important contracts for alternating current work, including two 600-KW. two-phase generators for the Corporation of Coventry; one three-phase generator and two three-phase motors for the Oakbank Oil Company; two three-phase generators and three three-phase motors for the Lancashire and Yorkshire Railway Company.

Electrical Wares Exported.

Week ending May 14th, 1901.		Week ending May 13th, 1902.	
Adelaide	Value £47	Alexandria	Value £42
,, Teleg. wire	74	Amsterdam	102
Alexandria	152	Bombay	98
Amsterdam	30	Boulogne	65
Auckland	120	,, Teleg. instruments	800
Bombay	19	Calcutta	1,233
,, Teleg. wire	88	,, Teleg. wire	130
Brisbane. Teleg. cable	51	Cape Town	828
Buenos Ayres	51	Colombo	103
,, Teleg. mat.	688	Copenhagen	87
,, Teleg. wire	800	,, Teleg. wire	42
Cape Town	100	Delagoa Bay	508
Christiania	45	Durban	1,133
,, Teleg. cable	22	East London	790
Copenhagen. Teleg. wire	82	Gibraltar	22
Demerara. Teleg. apparatus	44	Gothenburg	11
Durban	1,918	Hamburg	209
Fiume	307	Lyttleton	20
Ghent	15	Madras	30
Gibraltar	89	Melbourne	445
Gothenburg. Teleg. wire	14	Perth	420
Halifax. Teleg. wire	20	Port Elizabeth	58
Hong Kong	3,340	Shanghai	303
Kobe	172	Singapore	290
Kure. Teleg. cable	11,637	Stockholm. Teleph. cable	196
Launceston	45	Wellington	425
Liban	32	Yokohama	520
Malta	46		
Melbourne	888		
,, Teleg. mat.	3,44		
Montreal	24		
N. Atlantic. 338 knots teleg. cable	—		
Odessa	25		
Penang	9		
Perth	43		
Port Chalmers	235		
Shanghai	98		
Singapore	171		
Sydney	1,582		
Trieste. Teleg. cable	1,928		
Wellington	527		
Yokohama	1,528		
Total	£30,550	Total	£8,910

Foreign Goods Transhipped.

New York.	Elec. mat.	Value £480

Australian Electrical News.—Our contemporary, the *Australian Hardware and Machinery Journal*, says that some three years ago an experimental installation of electricity for carriage lighting was made on the Queensland Northern Railways. The system proved very successful, and 26 carriages are now lighted in this manner, the accumulators being placed at the end of the carriage and the power generated from the axle. Though it costs more than gas in the first instance, it is said to be cheaper in the end.

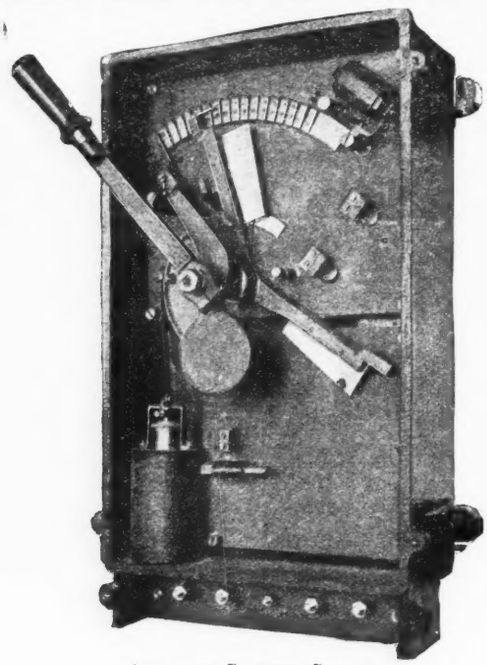
The same contemporary says that the return to the House of Representatives called for by Mr. Thomas, M.H.R., is questioned by that gentleman. The total shows 577 makers of electrical plant in all the States, of whom 223 are in Victoria. It is admitted that 176 of the Victorians are employed in attending on electrical plants. The 87 recorded in West Australia are all similarly engaged. Of the 32 in Tasmania only one is really employed in manufacturing, the other 31 being electricians and linesmen. At least 500 of the total are employed in attendance on 34 plants, all of which have been imported.

We also gather from the same exchange that the Sydney Council expects to call for tenders for certain electric lighting work about the end of May, the work to be under way within three months and completed about a year later.

An electrical installation was recently completed at the Carrington Hospital, Camden. The occasion is of special importance as marking the introduction of electricity as an illuminant in the hospitals of the State. In this particular case 135 lights have been installed, giving a total of 2,000 C.P. The whole cost, including engines and dynamos, amounted to £990.

Automatic Starting Switches. — The automatic starting switch, which we illustrate on p. 810, has been designed to meet the demand for a switch which will give absolute protection to the motor at a moderate cost. It is a Holmes-Broadbent patent, and is being manufactured by Messrs. Hodgson, Wright & Wood, of Halifax. The mechanism is enclosed in a fireproof cast-iron box, and is readily accessible by removing the iron cover. It includes a double-pole main switch as well as a starter, and it is absolutely impossible to close this switch before all the resistance has been inserted. This D.P. switch is held closed by means of a shunt or series coil, which releases and opens the D.P. circuit as soon as the supply fails. As soon as the D.P. switch is closed (by means of the handle outside the box) a trigger is released which allows the switch arm to travel over the contacts, due to the action of a weight and air dashpot. The speed of cutting out of the resistance is absolutely out of the control of the operator, but can be set to a fixed rate by someone in authority, according to the load on the motor, after which the lid is sealed up. The switches are therefore claimed to be specially suitable for motors connected with Corporation supply mains. The rate of cutting-out of resistance may be varied from a few seconds to three minutes; terminals are provided at the bottom of the case — two positive, two negative, and one field. A fuse or overload circuit breaker can be provided inside the case, but this is not recommended; small carbon leading finger is fixed to the switch arm, which takes up all sparks and so ensures a clean and smooth surface for the brush to travel over. The resistances are designed according to the length of time they are required to be in circuit, and are made of high resistance wire wound on asbestos tubes, and made up

into a frame, which is readily accessible at the back of the case. The switch is claimed to be especially suitable for large motors



Automatic Starting Switch.

which start fully loaded, motor pumps, hoists, motor hydro-extractors, motor fans, and motor printing machines. The figure shows the switch in the "off" position.

Bankruptcy Proceedings.—At Wednesday's sitting of the London Bankruptcy Court last week, held before Mr. Registrar Giffard, the public examination of George Willie Clarke, electrical engineer, late of Ethelburga Road, Harold Wood, and 15, High Street, Grays, was brought to a conclusion. The debtor started the Harold Wood business in November, 1900, and opened the Grays shop in August, 1901. During the month following he took an office and showroom at 117, Queen Victoria Street, E.C. He closed the Grays premises in November, 1901, and in December he executed a deed of assignment, upon which these proceedings were based. The accounts show total liabilities £5,269 17s. 1d., of which £3,373 5s. 2d. are expected to rank, against net assets £414 9s. 7d.

British Imports of Foreign Electrical Goods and Apparatus.—The appended table shows the value of the "electrical goods and apparatus" imported into the United Kingdom during each month of the past two years:—

	1901.	1900.
January	£94,317	£63,153
February	97,296	60,780
March	130,076	73,085
April	86,629	58,714
May	90,281	78,350
June	54,367	86,171
July	42,107	129,022
August	42,096	148,317
September	46,651	97,107
October	52,961	174,524
November	58,029	149,537
December	54,447	147,205
Total for 12 months ..	£849,257	£1,265,965

Brown, Boveri-Parsons Type Steam Turbines.—In the works of Messrs. Brown, Boveri et Cie., at Baden, the last trials are in progress of a turbo-alternator of 5,000 H.P. This machine, says *l'Industrie Electrique*, is intended for the municipal electricity works of Frankfort, and generates alternating current, single or three-phase, at a pressure of 2,500 volts, rotating at a speed of 1,000 revolutions a minute. The guaranteed consumption of steam per KW.-hour generated is 7 kilogrammes, superheated to 300° C., at a pressure of 13 kg. per sq. cm., which would correspond in a piston engine of the same power to a consumption of 4·2 kg. per I.H.P. Besides numerous turbo-generators of powers varying from 150 to 3,000 H.P., Messrs. Brown, Boveri are constructing at this moment a second machine of the same power, and intended for the electricity works of Milan.

Cable Contracts.—We are informed that during the last week contracts for cables were placed with the British Insulated Wire Company for extensions by Ashton-under-Lyne T.C.; Brompton and Kensington E.S. Co., Ltd.; Farnworth U.D.C.; Kensington and Knightsbridge E.S. Co., Ltd.; the Corporations of Dublin, Harrogate, Chesterfield, Portsmouth and Brighton; the Ogmore Valley Electric Company, and Willesden U.D.C.; in addition to tramway cables for the B.E.T. at Jarrow and South Shields, and telephone cables for the Glasgow Corporation. One British industry at least appears to be flourishing.

Catalogues, &c.—Messrs. R. W. Blackwell & Co., Ltd., of 59, City Road, have sent us an illustrated catalogue of their "Standard" and "Universal" electric motors and generators, linotype geared motors, desk and ventilating fans.

We have received from the Edison & Swan United Electric Light Co., Ltd., a copy of a brochure just issued, containing illustrations of some of the latest designs in artistic electric light fittings.

Messrs. Royce, Ltd., of Manchester, have issued a new list of their motors and dynamos, which are made to stock, ready for immediate delivery, in various sizes from 2 to 24 B.H.P., and for various voltages, open, enclosed, and semi-enclosed.

We have received from the Electrical Company, Limited, price list No. 4, dealing with generators for single and polyphase alternating currents. These are designed with either the armature or the field stationary, for belt or rope driving and for direct coupling, and the list gives particulars of sizes ranging from 30 to 6,400 KW., as well as information as to the weights, efficiencies, and other characteristics of the machines.

The Western Electric Company have issued a very fine catalogue of their telephone switchboards and accessories. Besides giving prices of switchboards up to 200 lines, with every conceivable accessory for construction, both within and without the exchange, excellent half-tone illustrations of very large multiple boards and of other features of a big exchange are given. Minor details are also well illustrated, there being 52 pages devoted solely to this purpose. The list is decidedly impressive.

The 1902 edition of the well-known volume—"Electricity"—of the General Electric Co. (1900), Limited, has just come to hand. We confess to a feeling of alarm when we think of reviewing this enormous work; we can only dip into it here and there. And first we notice a ground plan of the company's new works at Witton, near Birmingham, where they are concentrating their various establishments; the site covers 110 acres, and the electric power station which will provide motive power for the works will be equipped with plant of 5,000 I.H.P. An interesting feature is the carbon works, where all kinds of carbons for arc lamps, dynamo brushes, primary cells, &c., will be manufactured by special machinery. The employés of the Witton works are to be well accommodated in respect of lavatories and dining rooms, and cottages are to be built on the estate. The catalogue proper consists principally of the various sections issued during the past 12 months, and reviewed from time to time in these columns. The goods listed have been methodically classed and grouped in such a manner as to bring all like things together; the result is most successful, as a trial at once shows—any article out of about 100,000 can be at once located, and the indexes are admirable. Weights and measures with metrical equivalents, sample estimates, &c., provide for the needs of foreign and colonial customers. There are 11 sections, occupying about 1,000 pages and dealing with all kinds of electrical fittings and appliances. The section on fixtures and glassware occupies 272 pages, and an extraordinary variety of art metal fittings is shown—all of which, we understand, are of British manufacture. Special features are the company's standardised switchboards and switches, "Robertson" lamps, wires and conduits, Stanley measuring instruments and Aron meters, Angold arc lamps, traction material (a new section), Byng-Hawkins dynamos and motors, heating and cooking appliances, bells, telephones, and medical electrical apparatus. The volume concludes with a number of half-tone process illustrations of installations carried out by the G.E.C. The G.E.C. catalogue has appeared about every two years for the last 20 years, and is not merely an up-to-date reference book—it is of distinct educational value.

Chance for Huddersfield.—Great interest is being taken in a project to form a company at Huddersfield to introduce as a new industry a large concern for the manufacture of general electrical appliances. It is stated that an electrical engineering firm of high repute has offered to find £20,000 for the purpose of establishing works in Huddersfield, if local capitalists are willing to embark about £100,000 more. Further particulars are given in our "Notes" columns.

Coronation Illuminations.—We understand that the British Thomson-Houston Co., Ltd., have recently taken an order from one firm alone for 225,000 of their B.T.H.-Edison incandescent lamps. Allowing for what the other electrical companies are doing in this direction, and the steps taken by electricity supply authorities, both to illuminate their own buildings, and to facilitate the supply of electricity to the public, there is good reason to anticipate a blaze of electricity on June 26th and 27th.

Mr. J. T. Booth, of Burleigh House, Holloway, is making wooden crowns, letters, &c., fitted with batten lampholders for illumination purposes. The devices are made in various sizes, two of the crowns, for instance, having respectively 37 and 53 holders fitted.

Cryselco Lamps.—We learn from "Cryselco, Limited," that the unprecedented increase in their business has compelled them to supplement their means of output, by laying down a 100-H.P. Dowson gas generating plant, with Crossley gas engines. The Admiralty has just placed an order for 30,000 lamps with the company.

Electric Power for Printers.—A neat brochure bearing the above title has been issued by Messrs. A. W. Penrose and Co., of 109, Farringdon Road, E.C. The illustrations show various types of printing machinery driven by electric motors, while the letterpress draws attention to the advantages of the system, and gives data as to the cost as compared with old-fashioned methods of driving. Copies may be had by any printer free on application to the firm.

Finsen Light Apparatus.—The Sanitas Electrical Company, Limited, of 7A, Soho Square, W., are supplying the "Dermo" lamps for use in applying the "Finsen" light cure method. It is said to require only 5 amperes in order to produce, within three minutes, the same effect as that produced by the old Finsen lamp within an hour. The initial cost is very low, and a practitioner can carry out the treatment in his own consulting room. The pressure glass is in the "Dermo" lamp replaced by a disc of rock crystal which is pressed immediately against the skin and forms the objective lens of the tube, as it were. The patient feels

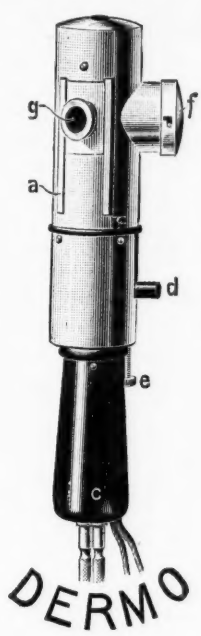


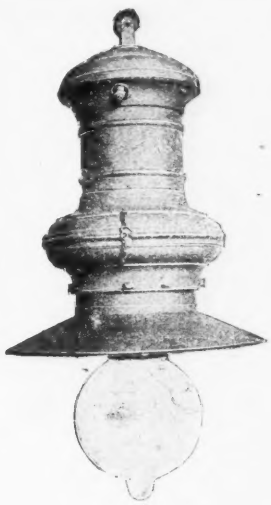
FIG. 1.

no sensation of heat, the temperature at a distance 4 in. from the arc light is not higher than 72° F. The irritating effect of the chemical rays is very obvious when this lamp is used. After a few minutes a well-marked erythema develops in a perfectly painless manner, and may persist for several months. The figure shows the construction of the apparatus. The lamp consists of a hollow windowed cylinder *a*, within which are fixed the exchangeable iron electrodes with water cooling apparatus. The casing is supported by a handle *c*, which receives both the conductors of current and a water-supply tube. The complete apparatus, therefore, is insulated in the most thorough manner; all parts, being conductors of electricity, are concealed in its interior, so that it is impossible for the operator to receive an electric shock. The hollow cylinder *a* may be readily unscrewed from the handle *c*. By simple pressure upon a spring *d* fixed to the handle the arc is formed, and the lamp made ready for use. The screw *e* regulates the amplitude of the arc. The rays issue through a tube *f*, projecting from one side of the case and terminating in a convex rock-crystal lens *i*, such lens at the same time serving as a "pressure glass," as used by Prof. Finsen in addition to the light-cure apparatus proper. As, practically speaking, the lamp does not become heated at all, the tube *f* may be pressed against the part of the body to be treated and the rays allowed to take effect in close proximity thereto. Moreover, the rock-crystal lens is removable, so that the light may be applied direct. Long and thin extension-pieces, in the shape of speculum, may also be screwed to the tube for insertion into the vagina, the cavity of the mouth, or the rectum, and thus permit the deeper-lying organs to be treated. A second aperture is provided in the cylinder itself, to meet those cases where it is desired to cause the source of light to act upon the body in almost immediate proximity without the interposition of the pressure-lens. When not in use, the opening *g* is closed up with blue glass, and serves as a window for observing the arc. The handle greatly adds to the convenience of this lamp: where the lamp is to be made stationary, the handle may readily be secured to a table or chair by means of a vice. The electrodes are arranged in such a manner that the current and water are conducted through two short tubes, which terminate in a sleeve upon which the iron points are fixed. When the iron points become worn out, as they do after having been used about 8 hours, they may readily be exchanged for others.

Trade Announcements.—We are informed that Messrs. Geipel & Lange have been appointed the sole agents for the United Kingdom and Colonies of Messrs. Chauvin & Arnoux, of Paris.

The Thames Valley Launch Co., Ltd., whose chief offices and works are at Weybridge, Surrey, announce that they will shortly open two new charging stations, one at Windsor and one at Reading. They offer special advantages to their own customers, *i.e.*, those who purchase boats from them or keep their boats with them by the year—the chief advantage being a reduction in the price of energy from 1s. 6d. per unit, the ordinary price charged, to 8d. per unit, which makes the cost of running the smaller size of boats approximately 2d. per mile.

Flame "Ark" Lamps.—Messrs. Johnson & Phillips claim as the striking feature of the flame "ark" lamp, which they are now putting on the market, the long life of the carbons with one trimming. The lamp is said to give a light of a rich golden colour, very becoming, and having high fog penetrating powers without using complicated mechanism. It is claimed to be moderate



in first cost, to consume little current, to be economical in carbon consumption, and to avoid frequent attendance and trimming. The lamps are suitable for indoor or outdoor lighting. Messrs. Johnson and Phillips have already made a special feature of "ark" lamps with coloured globes for Coronation illumination, and these flame lamps are also suitable for such purposes.

Spanish Customs.—The authorities have lately given a decision to the effect that plates and cylinders of charcoal and graphite, or of artificial carbon, for electric batteries, are dutiable under No. 139 of the Tariff, at the rate of 10 pesetas per 100 kilogs. (4s. 0¾d. per cwt.), and cylinders of the said materials for arc lamps under No. 292, at the rate of 2 pesetas per kilog. (£4 1s. 4d. per cwt.).

Summons.—As the result of the case adjourned from last month, the Lewisham and District Electric Supply Company have been fined £14 and £10 10s. costs for carrying out work in Lewisham not in accordance with the plans approved by the L.C.C. or the B. of T.

The Telegraph Wire Export Trade.—So far as the year has gone, the export trade in telegraph wire and apparatus connected therewith of this country has not shown anything like the activity recorded last year. During last month the shipments only attained a value of £54,541, as compared with £36,740 in the preceding month, and £548,709 in April, 1901. For the four months ending with April the returns show a total of only £803,896, which contrasts with £1,377,979 in the first four months of 1901.

What the British Consuls have to Say.—*Electric Tramways in Munich.*—Mr. John Ford, his Majesty's Chargé d'Affaires at Munich, in a report received at the Foreign Office on March 27th last, states that the electric tramways in Munich have entirely replaced the horse tramways which had been in existence for 25 years. On June 30th, 1901, there were 584 cars running, with sitting accommodation for 10,442, and standing room for 9,146 passengers, and six locomotives with electric accumulators for those short distances where overhead wires were not employed. The whole system is now 389 miles in length. The number of passengers at the uniform fare of 1d. was 44,581,688, and each electric car earned on an average about 5d. per km. The electric tram system in Munich gives employment to 1,179 persons, of whom 52 are female. The net income of the year 1900-01 was £31,672, of which sum, after payments to the reserve fund, &c., there remained £28,603, yielding a dividend of 11 per cent. The enormous number of accidents occasioned by the electric tramways have led to the trial of various safety measures, the best consisting in a net supported by an iron frame, which can be instantly lowered by the pressure of the driver's foot.

Lighting of Schools.—A report concerning the lighting of schools, drawn up at the request of the Bavarian Home Office, is quoted by Mr. Ford, who gives the following details from the report:—For school rooms not higher than four metres, and where gas light is already laid on, Auer's incandescent gaslight is considered the cheapest. The light is thrown by reflectors on to the ceiling, and one flame lights a floor space of 6 to 12 sq. metres. The flame stands at a height of about three metres from the floor. Black-boards are lit by special reflectors fixed on the boards. The electric arc light

with polished metal reflectors and the new Schuckert arc light lanterns have more resemblance to daylight; the first outlay is the same as for the Auer light, and the cost of burning only slightly higher, and even lower when electric power is obtained at a low price. Holophane shades are used. In rooms of 5 metres and higher, electric arc light is preferable to incandescent light. One lamp of 10 amperes is used for a floor space of 43 square metres; two lamps of six amperes each, for a floor space of 50 to 60 square metres. The arc light requires careful attention.

The Elektrizitäts Aktiengesellschaft (formerly Schuckert & Co.), of Nürnberg, according to a recent report on the trade and finances of Bavaria for the year 1900-01, employed about 1,000 men less last year than in 1900. Their shares quoted about 12 months ago at 245, dropped to 95, and are now said to be at 120, and they are reported to have paid no dividend in 1900—01, having paid 15 per cent. in 1898—99 and 1899—1900. On the Berlin Exchange, between January 1st, 1899, and October 19th, 1901, electric shares fell 61 per cent., there having been a loss of £13,540,500, among 21 companies having a capital of £22,177,500, owing principally to too rapid enlargement of their works and over-production.

The Electric Tramways of Nice.—Consul Alec. McMillan in his report on the trade and commerce of the Consular District of Nice for the year 1901, states that over 90 miles of lines are in operation. The system is partly overhead trolley and partly underground conduit, there being four or five miles of the latter in the centre of the town. There are 110 motor cars, four locomotives and 60 trail cars. About 50 more motor cars have been ordered. Goods, such as cement, coal, materials for construction, and other heavy goods are carried on some of the lines. The motive power is furnished by a transmission line over 20 miles long, and there is also a station worked by steam engines of some 2,000 H.P. to be used in case of necessity. The underground system is supplied by rotary converters. American firms have supplied the electrical apparatus and track materials. The boilers and cars are of French make. The daily receipts average about £200.

Proposed Auto-Trolley Line between Nice and Upper Monte Carlo.—A Maltese British contractor, Consul McMillan reports, has obtained a concession from the French Government for installing an auto-trolley line between Nice and Upper Monte Carlo. The line will be 12 miles long, and the gradients will in some places reach 10 to 11 per cent. The hydro-electric power will be furnished by a French company which already supplies the Nice Tramway Company. The cars are built for the accommodation of 16 persons, 12 seated and four standing, and their weight with full complement of passengers is not expected to exceed four tons. The wires will be suspended from wooden poles in the country, and from iron poles in the town. No tram rails are required to be laid down under this system, and the cars can deviate to right and left at will, crossing and re-crossing the road with as much freedom as an ordinary omnibus, and this independently of the overhead connections to the trolley wires. A small three-phase motor is suspended between the two conducting trolley-wires, which are set 12 in. apart; a flexible cable leads the motor current from the main line to the car, and the three-phase current from the car to the little trolley motor, which runs a little in advance of the car itself, in order that the flexible cable may have its proper tension. The trolley-motor and all its accessories weigh not more than 40 lbs. The pressure on the trolley lines will be 500 to 550 volts, the 10,000 volts three-phase alternating current being transformed through rotary converters installed in three sub-stations, one in the middle and one at each end of the line. It may be added that lines are now being constructed on this system in Marseilles and other places. The estimated cost of the 20 kms. of line, including all sub-stations, 12 cars and all other material for the working of the line will not exceed £40,000.

Proposed Additions to the Alpes Maritimes Tramways.—Consul McMillan states that the Consul-General of the Alpes Maritimes has under consideration a comprehensive programme of additions to the existing tramways of the department.

Electricity in Spain.—About 5 km. from Vivero, in the Consular district of Corunna (Spain), remarks Vice-Consul Guyatt, there is a cotton factory which, utilising a waterfall of 50 H.P. in the summer, and a considerably greater one in the winter, is producing at present electricity for the lighting of the town of Vivero with incandescent lamps at a very low price.

Galveston (Texas).—Electricity is largely used in the wharves and piers since their reconstruction after they were destroyed by the storm of September, 1900. The Mallory Steamship Line pier, constructed by the Galveston Wharf Company, is 1,278 ft. long; the sheds cover nearly 250,000 sq. ft., and are of most modern construction, with electric freight conveyors for loading and unloading cargoes. The pier of the Southern Pacific Railway Company, known as Pier B, is 14,000 ft. in length, and 650 ft. in breadth, and is stated to be the largest pier at present existing. According to the report of Consul Nugent on the trade of Galveston for the year 1901, there is room for seven large steamers at the pier at once, and nine acres of shed room, fitted up with electric conveyors and electric lights, so that work can be carried on both by day and night. The arrangements are such, that 320 railway cars can be parked at the end of the pier to receive freight from incoming vessels, whilst in the centre is a "battery" holding 275 cars, ready to be drawn on as the unloading progresses. There are 28 electric conveyors on Pier B, and it is estimated that 3,500 tons of merchandise can be discharged in 11 hours. In connection with the pier, a 500-H.P. electric plant is being erected, and a grain elevator to store 1,000,000 bushels is also being constructed.

Water-Power in Sweden.—Vice-Consul Carrick, in his report for the year 1901, states that the Sandviken Iron Company, at Sandviken, near Gefle, is making a new departure. The directors of the company are reported to have entered into a 50 years' agreement with the owners of a large waterfall at Uäs, on the Dal River, about 35 English miles south-west of Sandviken, for the hire of about 2,500 H.P. to be used in lieu of coals for the driving of the machinery at the works. The high price of coals, remarks the Vice-Consul, has given a distinct impulse to projects for the transforming of water-power to electrical energy for the driving of works, &c., so that the economic result of the Sandviken scheme will be watched with interest.

ELECTRIC LIGHT AND POWER NOTES.

Bettwsycoed.—At a D.C. meeting held on 25th ult., it was decided not to entertain the application of the National Electric Wiring Company for a prov. order to supply electricity for lighting and other purposes.

Bradford.—Owing to the greatly increasing pressure of the demand for electricity for all purposes, the Corporation has decided to advertise for tenders for the completion of the entire scheme for new works and plant. Under existing contracts only a portion of the new works was being proceeded with.

Cleckheaton.—The combined electricity works and refuse destructors which the U.D.C. is erecting, to the plans and specifications of Messrs. Baker & Appleby, the consulting engineers, and Mr. Lund, the Council's surveyor, is well advanced towards completion. Two of the steam dynamos (Belliss-Morcom-Johnson-Lundell) are ready for testing, and it is expected that the third set will be also ready before the end of the month. The switchboard is mounted at Messrs. Dorman & Smiths' works, and the boilers, condensers, pumps and steam piping are well in hand. The feeders and distributing cables are now being laid in the main streets. It is anticipated that the works will be opened in September.

Crook Colliery.—Messrs. Pease and Partners, Limited, the owners of Bankfoot Colliery, Crook, Durham, are making extensive and important alterations, which include the introduction of some important electrically-driven machines. Messrs. Pease have an electric lighting installation at Peases West which has been in existence for about two years, and now the firm is introducing four coal-cutting machines for "long wall work" to work in a clay seam or seams. An electric ram is also being fitted by a German firm at the coke ovens, which will load, press coal in and push coke out. The weight of the ram is 70 tons. It will have two motors and will be of 30 H.P. The Bankfoot works will be lighted on the series system, and at the ovens there will be five arc lamps of 1,000-C.P. each. The engine to drive the whole of the electric plant is one of Messrs. Robey's, of Lincoln, of 320-I.H.P., with rope gearing. The machine will have a capacity of 500 volts and 400 amperes. This will drive the four coal-cutters, the machines in the fitting shops and the Bankfoot electric lighting installation. Messrs. Reid and Ferens, of Sunderland and Newcastle, and Messrs. Scott and Mountain, of Newcastle, have the bulk of the work in hand.

Dorking.—The U.D.C. has appointed Mr. Trentham to act as consulting engineer in connection with the electric lighting scheme.

Dudley.—At the meeting of the Town Council last week Alderman Dunn presented a statement of the income and expenditure of the electrical undertaking. They had, he said, been very much deceived in the meters supplied to them on the recommendation of the B. of T., there being a difference of 65 per cent. in the amount of energy produced and that registered by the meters—a difference which the firm supplying the meters would have to make good. The engine put down to work the condensing plant also proved unequal to the work, and had to be supplemented by a 15-H.P. motor. The revenue amounted to £6,117 13s. 3d., and the claim they had made amounted to £637 7s. 4d., making, with other items, a total of £6,816 6s. 7d. The expenditure included salaries, £1,053; coal, £1,934; water, £241; general stores, £128; repayments and interest on loans, £2,845; and smaller items, making a total spent, £6,648, leaving a net profit of £168 7s. The number of units generated for traction was 688,678; for private purposes, 238,292; street lighting, 37,385; station lighting, 10,145; testing, 3,026—total, 977,824. He believed that no other town had the electric light at the same price, and at the same profit. A new 500-KW. machine was being laid down, which would bring the power of the generating plant up to 1,200 KW. There was a gross profit of £3,000. Councillor Bean said that, as part of the estimated income was in litigation, it would be better financing to say that there was a net loss of £400.

Epsom.—A resident has complained to the U.D.C. of the intolerable nuisance caused at the electric light works, stating that he had been assured it could be obviated by laying down condensing plant. It was mentioned that the noise complained of was not caused by the machinery, but by the emission of exhaust steam.

Farnham.—The U.D.C. has decided to ask Edmundson's Electricity Corporation to proceed with their promised investigations and report for lighting the district, but on the understanding that the Council does not pledge itself to adopt electricity. The Council already possesses a provisional order.

Frome.—At the U.D.C. meeting on the 5th inst. it was decided to apply to the L.G.B. for a loan for electric lighting.

Germany.—A central electric lighting station and an electric tramway are about to be established in the town of Hildesheim.

Godalming.—The T.C. has entered into a contract with the Urban Electricity Supply Company to light the district for 10 years, the period to be determinable at the option of the Council in five or seven years. The annual charges are as follow:—Ten 750-c.p. arc lamps, £104; 105 50-c.p. incandescent lamps, £390; 109 25-c.p. ditto, £299 15s.; total, £793 15s. This amount is £100 less than the present charge for 263 gas lamps, £100 more than an offer of the Gas Company to light the district with Welsbach burners, but nearly the same as an amended offer of the company to improve the lighting at a total annual charge of £788. The lamps will burn from sunset till midnight.

Halifax.—There is likely, in the immediate future, to be a party struggle among the members of the municipality on the rival claims of gas and electricity. The initial cause of the contest is the heavy expenditure during the last 18 months on the extension of the gas works. The Council has agreed to refer the whole subject of electricity *v.* gas to a special committee.

Harrogate.—The T.C. has resolved to ask sanction to borrow £46,000 for purposes of electric light extensions.

Heston and Isleworth.—Mr. Enright has been instructed by the U.D.C. to prepare a scheme for the electric lighting of the district.

Kingston.—The T.C. has decided to push on with the arc lamp extensions, in spite of the adverse resolution passed at a public meeting last month.

London.—Westminster.—On Wednesday last week the underground mains of the Charing Cross and Strand Electricity Supply Company fused in Cranbourne Street, and also involved the cables of the Metropolitan Electric Supply Company. Nine of the disconnecting boxes were destroyed.

Manchester.—At a recent meeting of the City Council, Dr. Bishop stated that the Electricity Committee had never made an authorised offer to supply the Stretford district on the same terms as the citizens, and on a 12 years' lease. Manchester could not recoup itself in a less period than 21 years. The Corporation was prepared to meet the Stretford Council in regard to the lease, and also as to other terms, and the Committee would be able to supply Stretford with energy earlier than was possible by the district itself.

Mansfield.—The foundation stone of the generating station was laid last week. The installation is estimated to cost £50,000.

Middlesbrough.—At a meeting of the E.L. Committee of the Corporation on 8th inst., it was reported that the income from sale of current had been £4,677 1s. 6d. net, and there was a gross profit of £2,126 3s. 3d. When payments had been met there was a deficit of £971 8s. 2d. On the recommendation of Mr. Hammond it was agreed that the charge to consumers be reduced from 7d. to 6d. per unit. The following scale of charges for motive power was approved:—Up to 250 hours' use per quarter, 2d. per unit; between 250 and 500, 1¾d.; between 500 and 750, 1½d.; between 750 and 1,000, 1¼d.; and above 1,000, 1d.

Morley.—The deficit on the E.L. undertaking for the year ending March 25th was £1,788 12s. 4d., against a deficit of £2,002 3s. 5d. in the previous year.

Natal.—A scheme has been matured for the supply of electricity for lighting purposes in the Durban passenger and goods yard, locomotive workshops, &c.

Newport.—The Electricity Committee has notified the contractors for the steel framework of the new power station, that they will be held responsible in damages for losses caused by the delay in completing their contract. Mr. Parshall, the consulting electrical engineer, estimates the loss caused at £1,000 to £1,200 per month. Mr. Parshall has been instructed by the Committee to submit a scheme for providing a supply of current for power purposes, the Corporation having resolved that conduits for power mains shall be laid in conjunction with those for traction purposes. There is a great demand amongst the smaller workshops of the town for electricity as a motive power.

The consulting engineer reported that owing to a disagreement with the contractor in regard to certain work pertaining to the foundations, it was decided to include this work in the building contract, but through inadvertence the quantities were omitted. It has been decided to pay the extra sum required by the contractor. Mr. Parshall also submitted a statement showing the work which remains to be given out in connection with the scheme as follows:—Remainder of drainage system; outside coal handling apparatus; weigh bridge for coal trucks; lighting of generating station and car sheds; overhead construction in car sheds and yards; necessary appliances in power station.

The Electricity Committee are offering special terms of 1d. per 8-c.p. lamp per night for current for Coronation illumination purposes.

Portsmouth.—It was announced on 8th inst. that the gross profits on the Corporation electric light undertaking for the past year had amounted to more than £4,000. Last year there was a deficit of £800.

Southampton.—Col. W. R. Slacke, R.E., L.G.B. inspector, has held an inquiry into the application of the T.C. for leave to borrow £30,000 for electric lighting purposes, including the reclamation of the foreshore and the erection of a new electricity works. Two 500-kw. steam dynamos are to be installed.

Spain.—La Sociedad Hidro-Electrica Iberica, of Bilbao, is applying for a concession to put down plant to utilise the water-power of the River Ebro at Cerecada in the generation of electrical energy.

Spennymoor.—The station built by the Northern Counties Electricity Supply Company is now nearly ready. The Callender Cable and Construction Company have laid 45,000 yards of cable. The power station is fitted up with two compound three-crank engines, by Messrs. W. H. Allen & Son, of Bedford, coupled to 200-kw. dynamos by Messrs. Crompton & Co. Messrs. Babcock and Wilcox have supplied the boilers, with chain grate stokers. It is expected that very soon current will be supplied to customers. The U.D.C. has asked the company to tender for street lighting.

Stockton.—On the recommendation of the engineer the T.C. on 6th inst. decided to call for tenders for additional plant, including one engine and two dynamos, with an output of 300 kw., two Lancashire boilers, switchboard extensions, a surface condenser and cooling plant, extension of feeder cables and mechanical stokers.

Tadcaster.—A corn mill has been converted into an electric light works, and a company formed by the residents. About 600 lamps are about to be installed.

Torquay.—The electric lighting revenue from April 1st, 1901, to December 31st last was £5,314, and the total expenditure and amount transferred to reserve fund was £3,680, reducing the debit balance from £2,459 to £826.

An action against the T.C., charging it with permitting a smoke nuisance at the electric lighting station on March 18th, has been settled, defendants to pay the costs. The Corporation had done its best to abate it, and promised to continue its efforts.

Worcester.—The T.C. has decided to order, under Messrs. Bruce Peebles & Co.'s contract as an extra, an exciter for the Tybridge works, at £54 10s., and from Messrs. Ferranti, Limited, 95 continuous-current meters for £240; and has authorised the engineer to lay a cable at a cost of £428. It has also decided to apply to the L.G.B for sanction to borrow £1,000 to defray the cost of the meters and demand indicators.

Worthing.—At the T.C. meeting held on 6th inst., it was stated that the applications received for current are equivalent to 8,600 8-c.p. lamps. The new buildings required for the extension of the electricity works are estimated to cost £3,500.

ELECTRIC TRACTION NOTES.

Belgium.—The municipal authorities of Liége have decided to double the electric tramway on the Guillemins-Coronmeuse branch, and are inviting tenders for the construction of the line and the erection of the overhead conductor.

Bradford.—The Corporation, after much experimenting with patent dry seats, has given an order to Mr. Jas. Pickles, of Bradford, for the seating of six cars at £11 10s. per car.

Cavehill and Whitewell.—The Bill for electrifying the Cavehill and Whitewell Tramway, promoted by the B.E.T. Company, has passed the second reading, but the Belfast Corporation—which has shown such laxity in its own tramway affairs—is anxious to purchase the line, or the portion of it inside the city boundary, and to pay the B.E.T. any cost it has incurred in promoting the Bill. The people of the Glengoomley suburb are against the Corporation, and so is the U.D.C.

Halifax.—Some time ago the T.C. proceeded to lay a cable from the new sub-station at Hebden Bridge, and now that the work is about completed, the L.G.B. object that it is not laid in accordance with their requirements. It is said that the necessary relaying will involve an expenditure of some £2,000.

London.—Plans for the electrification of the North Metropolitan Tramways Co.'s system, leased from the County Council, have been deposited with that body by the company.

Isle of Man.—The Clerk of the Rolls, Sir James Gell, at Douglas, on 7th inst., granted the application of Mr. Ernest Schenk, of 20, Queen Victoria Street, London, for an extension of time to complete the purchase of the electric tramway undertaking of the Isle of Man Tramways, Limited, to 31st inst. The purchase price is £252,000, and comprises the line from Douglas to Ramsey and the line from Laxey to the summit of Snaefell, together with stations, plant and rolling stock.

Mumbles.—Some accumulator cars have been ordered with a view to experiments in connection with the suggested electrical equipment of the Mumbles Railway.

Newcastle.—The Chairman of the Electric Tramways Committee recently made a statement relative to the profits of the concern. He said the usual monthly receipts were (for the month ending May 3rd—five weeks) £11,509, or an average of 11d. per car-mile. They had carried 2,500,000 passengers, and the car mileage was 252,000. The expenditure for the last five weeks, as far as could be ascertained on April 26th, was, salaries £383 1s. 7d., wages £4,537 9s., coals £239 18s. 6d., stores purchases £1,000, making a total of £6,160 10s. To this must be added the five weeks' proportion of the interest and redemption which the city treasurer placed at £41,000 for the year, and which might be put down at £3,940. Therefore, there was a balance left between the receipts and the expenditure of £1,408 18s. 2½d. The average receipts for the last two weeks had been £2,456. The actual figures for the last week (which was the heaviest week they had had in regard to salaries) was, salaries £76, wages £991, coals £48, and stores between £120 and £150, one week's interest and redemption £788, or a total of £2,053, leaving an apparent balance per week of £403. That worked out at £20,956 for the year. Against this had to come several things that they could not reckon by the week, for instance, car licences £200, insurance policy (third party risks) £1,500, insurance of employés £250, rates and taxes £1,000, repairs of permanent way, as estimated by the city engineer, £1,500, renewal fund (power station and electric equipment) as estimated by the tramway department, £15,000. That gave a total of £19,456, or left a yearly balance worked out on the present week's receipts of £1,506. If they had been about correct in estimating the renewal fund, they might say that the trams were practically paying every expense and leaving a small surplus.

Spain.—Application has been made for a concession to establish a system of electric tramways between Seville and three small towns in the neighbourhood.

Stretford.—The U.D.C. has confirmed the plans, specifications and estimate prepared by Mr. C. H. Wordingham for the reconstruction and electrical equipment of the tramways within the district, and application is to be made for sanction to borrow the sum of £54,680 for the purpose.

Twickenham.—Not being able to come to terms with the frontagers, the L.U.T. have decided to lower the water mains 3 ft. in Heath Road.

Wallasey.—The U.D.C. has decided to order five new cars of the Preston type.

Wallsend.—An accident occurred to a tower wagon on the 8th inst. belonging to Messrs. Dick, Kerr & Co. It was being used by three workmen for fixing overhead wires, when the carman in charge of the horse received instructions to move to another standing, and when turning the animal round the wagon capsized. The occupants were precipitated on the ground, and one sustained a dislocated ankle and other injuries. The other two escaped being hurt with the exception of shock.

Wolverhampton.—On Friday last a collision occurred between an electric car and an omnibus; the car was proceeding up Darlington Street, but when near the top it came to a standstill and commenced to run backwards, gathering impetus, until it struck the 'bus. The conductor of the latter was seriously injured.

TELEGRAPH AND TELEPHONE NOTES.

The Indian Mutiny.—On 19th ult., at Delhi, Lord Curzon unveiled a monument erected to commemorate the services of the Delhi Telegraph Signallers during the mutiny of 1875, in giving the first warning of the rising to the authorities. The Viceroy also decorated W. Brendish, the survivor, who sent the actual message, with the medal of the Victorian Order. His companions were named respectively Todd (killed by the mutineers) and Pilkington. Other names were also inscribed on the monument.

Marconi and Wireless Telegraphy.—Signor Marconi lectured in Dundee on the 6th inst., on the subject of "Wireless Telegraphy." The lecture was largely historical, and referred at length to the work of Bowman Lindsay, as one whose name would be handed down to posterity as that of the first man who thoroughly believed in the possibility of long-distance wireless telegraphy. Signor Marconi afterwards went on to say that he began his experiments in 1894 and 1895, and that since communication by his system was established between the South Foreland and France two years ago, the development and improvement of the system had been extremely rapid. Forty coast stations were equipped by it in Great Britain and Europe, and on 66 vessels of the British Navy and 12 of the Italian Navy there were installations.

Pacific Cable.—According to the *Daily Chronicle*, the Pacific Commercial Cable Company has increased its capital from three to twelve millions. The object of the increase is to provide the money necessary to complete the proposed San Francisco—Manila cable.

The St. Pierre Disaster.—We learn from Professor Jamieson that Mr. Chas. Cruickshanks, M.A., the chief electrician on board the West India and Panama Telegraph Company's repair steamer *Grappler* which has been lost, left her for home before the accident, but that his successor, Mr. Murphy, also a Glasgow student, has gone down with her. By a curious coincidence, a son of the Professor, S. T. Jamieson, was to have taken up his duties ere this, as second to Mr. Murphy, but was unavoidably prevented, and thus he has escaped. The present second, Mr. Hanna, was not on board, as he is at present on shore through an accident.

Telegraphic Interruptions and Repairs :—

Cables.	Interrupted.	Repaired.
Latakia-Cyprus	June 20, 1899 ..	..
Alexandria-Laruaca	Jan. 19, 1902 ..	..
Puerto Plata-Martinique	May 5, 1902 ..	..
St. Lucia-Martinique	May 7, 1902 ..	..
St. Lucia-St. Vincent	May 7, 1902 ..	..
St. Lucia-Grenada	May 7, 1902 ..	..
Guadeloupe-Martinique	May 7, 1902 ..	..
Landlines :—		
"*Via* Hanekin" on Persian territory	Feb. 24, 1900 ..	..
Communication with Baranquilla and Cartagena	Dec. 8, 1900 ..	..
Guanta-Barcelona	March 17, 1902 ..	..
Barcelona-Ciudad Bolivar	March 6, 1902 ..	..
Puerto Plata and San Domingo	April 26, 1902 ..	May 7.
Lougowaia-Khabarowsk	May 7, 1902 ..	..

West Indies.—According to the *Times*, the cables south of St. Lucia are interrupted owing to the disastrous earthquake eruptions which took place in that region last week.

CONTRACTS OPEN AND CLOSED.

OPEN.

Barking.—June 6th. Motors, pipework, chequer plating, &c. See "Official Notices" May 9th.

Beckenham.—June 6th. The U.D.C. wants tenders for incandescent lamps. See "Official Notices" to-day.

Bedford.—May 17th. Fuel economisers for the Corporation. See "Official Notices" April 25th.

Brighton.—June 9th. Points, crossings, tie-bars, bolts, &c., for the Corporation tramways; also 300 tons of steel rails. See "Official Notices" May 9th.

Burton-on-Trent. — May 30th. Tenders for three 100-KW. tramway generators, switchboard, three Lancashire boilers, steam pipes, jet condensing plant, economiser, &c. See "Official Notices" to-day.

Bury.—May 20th. Jet condenser and pumps for the electricity works. See "Official Notices" May 2nd.

Coventry.—May 26th. Steam and water pipes and accessories. See "Official Notices" May 9th.

Dudley.—May 20th. Motors for the E.L. Committee. See "Official Notices" May 9th.

Dudley.—June 6th. Tenders for the supply of incandescent lamps, and oil. See "Official Notices" to-day.

Glamorgan.—May 31st. Electric wiring, &c., for Parc Gwyllt and Angelton Asylums, near Bridgend. See "Official Notices" May 9th.

Glasgow.—June 7th. Economiser and condensing plants. See "Official Notices" May 9th.

Govan.—May 27th. Fuse boxes, meters, demand indicators, manhole and joint boxes, &c., for 12 months for the electricity department. See "Official Notices" May 9th.

Halesowen.—May 21st. The Council wants offers for taking over its electric lighting and light railway powers. See "Official Notices" May 2nd.

Hungary. — September 1st. The authorities of Kolozsvár, in Hungary, want to introduce electricity for lighting and power purposes. See "Official Notices" May 9th.

Hunslet.—June 3rd. Tenders for two electric lifts. See "Official Notices" to-day.

London, S.W.—July 31st. The War Office wants tenders for self-propelled lorry (oil). See "Official Notices" April 25th.

Middlesbrough.—The electric wiring of the Large Hall at the Royal Exchange. J. M. Bottomley & Son & Welburn, architects, 28, Albert Road, Middlesbrough.

Oldham.—May 20th. Cables, troughing, bitumen, and insulators for the Greenhill station. See "Official Notices" May 9th.

Poplar.—May 28th. Tenders wanted by the M.B.C. for special armoured cable. See "Official Notices" to-day.

Poplar.—May 28th. Tenders wanted by the M.B.C. for 130 cast-iron arc lamp columns. See "Official Notices" to-day.

Poplar.—May 28th. Wiring (conduit) and fittings at Union Offices. See "Official Notices" May 9th.

Roumania.—May 31st. Tenders are being invited until May 31st by the municipal authorities of Calarashi—Stirbeiu for the concession for the electric lighting of the town during a period of 35 years.

Stockport.—May 21st. One water-tube boiler for the electricity works at Millgate. See "Official Notices" May 9th.

Swindon.—May 19th. 252 accumulator cells and accessories for the Corporation electricity works. See "Official Notices" May 2nd.

Wallasey.—May 17th. The U.D.C. invite tenders for the maintenance of the electric installation on their steamers for a period of 12 months from July 1st next. H. W. Cook, Clerk, Public Offices, Egremont, Cheshire.

Warrington. — June 2nd. Tenders for drivers' and conductors' uniforms. See "Official Notices" to-day.

Worthing.—May 26th. Tenders wanted for one 250-kw. steam dynamo and one dry-back boiler. See "Official Notices" to-day.

CLOSED.

Bradford.—The Corporation has accepted the tender of the Keighley Engineering Co., Ltd., for two 20-H.P. motors for hiring out purposes for the sum of £198. It has also accepted the tender of Messrs. E. Green & Son, Ltd., for an economiser at £1,580, and dampers for £68; and the tender of Messrs. Ferranti, Ltd., to supply and erect two switchboards for a total of £670. Messrs. Cole, Marchent & Morley have been instructed to supply the spare parts for the two 2,000-H.P. engines, shortly to be delivered by them, for the sum of £364 10s.

Cardiff.—The Corporation has accepted the tender of Messrs. Dick, Kerr & Co., Limited, for 20 double-deck double-bogey and 20 double-deck single-truck cars.

Elland.—The following tenders have been accepted by the U.D.C. for the electricity works:—Engines, Messrs. Belliss and Morcom, Ltd.; dynamos, Messrs. Greenwood & Batley; storage battery, Messrs. Ashmore, Benson, Pease & Co., Ltd.; switchboard, Mr. H. H. Wright; crane, Messrs. J. Hitchen & Son; cables, Anchor Cable Co., Ltd.; condensers, Messrs. Thornton & Crebbin.

Holwell Iron Works (Leicestershire).—The tender of Messrs. Belliss & Morcom, Limited, has been accepted for two 220-H.P. engines for the electrical power installation about to be put down at these works.

Llandudno.—The T.C. has accepted the tender of Mr. Evan Hughes at a sum of £2,060 for proposed extension of the electric lighting works.

London.—The London County Council received the undernoted tenders for wiring and fittings in connection with the Scotland Yard fire brigade station:—

C. O. Clark (accepted)	£134 15 0
Nunn, Watts & Co.	145 0 0
C. Mickleburgh	157 10 0
A. Goldsmith & Co.	165 0 0
Jackson Brothers	168 8 0
Anti-Vibrator, Limited	170 0 0
W. Mossop & Co.	171 0 0
Harrods, Limited	176 15 0
E. Deane	203 1 0
Lawrence & Co.	220 9 6
G. Benkert	320 0 0

The tender of Messrs. Thos. Parker, Limited, amounting to £171, has been accepted for the supply of an electric motor for the Horton Asylum, and that of Tangye's Tool and Electric Company for machine tools for the sum of £131 15s.

Peterboro'.—The tender of Messrs. McKenzie Bros., of Edinburgh, for the supply of arc lamp pillars, amounting to £445, has been accepted.

Portsmouth.—The T.C. received the following tenders for transformers:—The British Electric Transformer Manufacturing Co., Ltd., £1,468 10s.; Siemens Bros. & Co., Ltd., £1,621; Ferranti, Ltd., £1,393 10s.; The Brush Electrical Engineering Co., Ltd., £1,308 10s.; the last named was accepted.

Rathmines.—The Council has accepted the following tenders for the extension of the electricity supply works and mains:—One 300-KW. steam dynamo, pipework and accessories (with Willans engine), Dick, Kerr & Co., £3,547 10s. 8d. Extension of switchboard, Kelvin & James White, Limited, £174. Supply mains, British Insulated Wire Company, Limited, schedule rates for various cables.

Sheffield.—The Tramways Committee has accepted the tender of a local firm, Messrs. Cravens, Limited, of Darnall, for 20 double-deck cars for the sum of £12,800. Hadfield's wheels are to be supplied, and half the cars are to be delivered by August 16th, 1902, and the remainder by October 1st of the same year. The Committee has also adopted the tender of Messrs. Cole, Marchent and Morley, Limited, for the supply and erection of one 1,000-KW. generator for the new engine at £3,200, and has given permission for this work to be sub-let to the British Thomson-Houston Company, Limited. The tender of the Wheeler Condenser and Engineering Company, Limited, for the supply of one condenser and feed water heater and pipes complete, at a sum of £1,480, has also been accepted. The Barrow Hematite Steel Company, Limited, has received an order to supply 1,000 tons of steel rails and fishplates, at £7 7s. 6d. per ton.

South Africa.—The Koffyfontein Mines, Limited, have placed an order with Messrs. Dick, Kerr & Co., Limited, for a complete electrical plant for haulage and lighting at the mines.

Warrington.—The T.C. has resolved that the tender of Messrs. Bennie & Thompson, for the construction of the permanent way for the tramways to Longford Bridge and the Cemetery for the sum of £16,857 14s. 6d., be accepted; also that the tender of Messrs. R. W. Blackwell & Co., Ltd., for constructing the overhead equipment for the sum of £2,736 19s. 2d., be accepted, subject to power for borrowing the money being obtained. It was decided that application should be made to the B. of T. for sanction to borrow the sum of £27,000, that being the estimated cost of constructing the tramways as furnished by Messrs. Preece & Cardew.

FORTHCOMING EVENTS.

Wednesday, May 21st.—At 7.30 p.m. Institution of Electrical Engineers (Students' Section). Annual General Meeting. Paper to be read:—"Some Notes on recent Continuous-Current Dynamo Design," by Mr. F. J. Hiss, jnr.

Thursday, May 22nd.—At 8.0 p.m. Institution of Electrical Engineers. Annual General Meeting at Society of Arts, John Street, Adelphi, W.C., for Members, Associate-Members, and Associates only. To receive the annual report of the Council and statement of accounts and balance sheet for the 12 months ending December 31st, 1901. The announcement of the election of the new Council will also be made at this meeting.

NOTES.

London County Council.—At a meeting of the Council on Tuesday, it was decided to lend £37,430 to the Shoreditch M.B.C. for expenditure in connection with the Hoxton generating station.

The Parliamentary Committee reported that the Council had no power to utilise the site which had just been purchased at Pimlico at a cost of £80,000, for the purpose of a power station for the tramways. Instructions had been given for the necessary steps to be taken to obtain the powers desired in the present session.

Mr. J. A. Baker stated that the effect of the decision in regard to the Council's tramway Bill, provided that it was maintained in the Lords and the Bill passed, would be that the Council would have a continuous service from the north to Westminster Bridge. The Committee had decided that a tramway should be allowed from Westminster Bridge to Waterloo Bridge, whence the Council's shallow tramway would lead to Theobald's Road and the north.

The Parliamentary Committee presented a report in relation to the rejection of the Council's Electric Supply Bill. The Committee remarked that a general objection urged against the Bill was that there was no pressing need for the legislation sought, inasmuch as the powers of the local authorities to compulsorily purchase under the Acts would not operate till 1931. The Committee, however, pointed out that it was open for the purchase by agreement of an undertaking within one borough to be carried into effect at any time, and that, "It was much fairer to the companies that the matter should, if dealt with at all, be disposed of soon, without waiting for years to elapse, and the date of purchase to become imminent, and thus misleading the companies by allowing them to suppose that local authorities are perfectly satisfied with their powers of purchase as at present laid down by Parliament."

Fatality.—A fatality occurred at the Pinkston power station on the 9th inst. A labourer employed to superintend the coal and ash conveyer, in attempting to clear one of the buckets which had choked, stepped on it. It overturned, and his legs were imprisoned. Before assistance could be rendered, the unfortunate man was crushed, and died on the way to the infirmary. Another report states that he fell on the conveyer and was crushed to death between it and one of the feeding hoppers; it is surmised that he had been using his foot to loosen the coal, which had evidently choked in the mouth of the hopper.

Institution of Junior Engineers.—A paper was read by Mr. L. H. Rugg on 2nd inst. before this Institution, on "Some Factors in Colonial Railway Construction." The paper dealt mainly with track construction.

Institution of Mining Engineers.—The thirty-sixth general meeting of the members of this Institution will be held on May 29th, at 11 a.m., and May 30th, at 10.30 a.m, in the rooms of the Geological Society, Burlington House, Piccadilly, London, W. Arrangements have been made for visits to works on May 31st. Further particulars can be obtained from the secretary, Mr. M. Walton Brown, Neville Hall, Newcastle-upon-Tyne. On the second day there will be a paper on "Electric Traction on Roads and Mineral Railways," by Mr. W. R. Cooper.

The Electricals.—This new club, whose headquarters are at the Bedford Head Hotel, Tottenham Court Road, is having a smoking concert there on Friday next, May 23rd, at 7.30 p.m., at which the president of the club, Sir David L. Salomons, Bart, M.A., M.I.E.E., &c., will preside. An excellent programme has been arranged, and the secretary, Mr. F. E. Oldham, is making every effort to make the occasion in every way successful.

Niclausse Boiler Trials.—According to the *Times* for May 9th, the *Seagull*, t.g.b., has completed her series of trials with Niclausse boilers for the information of the Boiler Committee. At her first eight hours' trial at 1,000 I H P. the actual mean power was 1,029, when the coal consumption worked out at 2·28 lbs. per H.P.-hour, and the make-up feed water necessary to replace wastage was 32 lbs. per H.P.-hour. She next ran for eight hours at nominally 3,000, but actually at 2,804 I.H.P., when the coal consumption was 2·15 lbs, and the make-up feed water required was 67 lbs. Her third run was intended to extend over 50 hours at 2,500 I H.P., but at the end of 18 hours she ran into a fog and the trial had to be suspended for six hours. The coal consumption during this part of the run worked out at 2·14 lbs. per unit of power per hour and the make-up feed water required was 35 lbs. The trial was resumed at 2,300 I.H.P., and while there was no appreciable difference in the consumption of make-up feed water, the coal consumption advanced to 2·47 lbs. per horse-power-hour. The vessel had then to ease down through stress of weather, and as the coal was running short the trial was not resumed.

The Institution of Electrical Engineers.—At last week's meeting of the Institution Mr. Langdon, the President, called attention to the present position of the building fund. It now reached the sum of £10,000, but it would be necessary to have a far larger amount in hand before any practical steps could be taken towards the realisation of their idea. He pointed out the pressing need there was for a suitable building to act as the recognised centre of their activities, and made an earnest appeal to the 4,000 members associated with the Institution to help. If each did his part, and the average annual donation towards this object did not fall short of one guinea per member, the Council would soon be in the possession of enough capital to warrant them in proceeding with the scheme.

University College, London.—On Friday last a meeting was held at the Mansion House in aid of the appeal for funds in connection with the above college, to which we have already drawn attention. The Lord Mayor presided, and was supported by a large number of members and the very influential committee which has been formed under the chairmanship of Lord Brassey to promote the above object. The total sum required amounts to £1,150,000, of which £250,000 is for extensions of buildings and laboratories, £200,000 for maintenance, and £700,000 for endowment of professorships and lectureships.

The Lord Mayor introduced the subject, with a reference to the work already done by the Corporation and the City Guilds, and to the need for further efforts, in order to maintain our position among the nations. University College must first be made efficient; afterwards, King's College will be taken in hand. Already the Drapers' Company has contributed £30,000.

The Secretary having read letters of regret from distinguished persons, the Lord Mayor called upon the Duke of Devonshire to move the first resolution. The Duke read an extract from his speech on introducing the University Commission Bill into the House of Lords, to explain the object and scope of the undertaking, viz., to constitute the existing Institution a teaching university on most up-to-date lines. For this, funds are indispensable. The affiliated colleges must be incorporated. Universities are no longer a necessity for one class alone; we must find the best men of all classes, and educate them to the utmost. The older universities have already taken steps to provide for the new wants, but they also are hampered by the lack of funds. His Grace looked hopefully towards the "modern millionaire" to remedy the deficiency, and cited the magnificent donations to American Universities. A chance has now arisen for Londoners to endow a University which shall be worthy of the Empire and of the Metropolis. His Grace detailed the conditions under which the incorporation would be effected, the sum immediately required being £100,000, of which £45,000 has been promised. The Duke then moved a resolution approving of the incorporation and endowment of University College, which was seconded by Sir Michael Foster, supported by Prof. A. W. Rücker, the Principal of London University, who hinted at commercial and industrial educational facilities in the future, and carried unanimously.

In Mr. Ritchie's absence, Lord Brassey, chairman of the Appeal Committee, moved a resolution urging the importance of a generous response to the appeal. The methods of other countries must be studied and emulated. Lord Avebury seconded the resolution, and testified, from his experience for 35 years as member and sometime vice-chancellor of the University of London, to the excellent work done by University College. The resolution was supported by Mr. Lionel Phillips, who spoke as a business man, and emphasised the urgent necessity of educational reform. Complete re-organisation, and far greater funds, are essential. Education is as important as Imperial defence, for if we do not apply scientific methods to our industries, we shall lose the position which enables us to provide funds for the Army and Navy. A player in a game of skill must study not only his own hand, but also those of his partners and opponents. Combinations may be alarming at first, but science must triumph; however, the combination of educational institutions cannot but do good. Mr. Phillips's firm is deeply impressed with the necessity for even greater efforts.

Mr. H. R. Beeton also supported the resolution in a weighty speech, pointing out that not only our power and pride, but our prestige, are involved in the fight for trade, and he gave some startling statistics as to recent American benefactions. Captain Jessell also spoke, and the resolution was carried.

The Treasurer, Sir R. Farrant, then stated that subscriptions already received amounted to £110,000. Lord Reay, President of the College, moved a vote of thanks to the Lord Mayor, which was seconded by Mr. Prevost, Governor of the Bank of England, and carried.

National Telephone Company's Dinner.—The ninth annual staff dinner of this company was held on Friday evening last at the Trocadero Restaurant, the general manager, Mr. W. E. L. Gaine, presiding. The company numbered about 200, and included the president, Sir H. Fowler, Lord Harris, Sir J. Fergusson, Sir A. Rollit, Prof. S. P. Thompson, Messrs. D. Sinclair, H. Edmunds, E. Garcke, J. E Kingsbury, M. Byng, F. J. Madgen, Sir Jas. Woodhouse, E. Forbes Lankester, and many other well-known person.

After the loyal toasts, the chairman communicated the regret of Sir G. Franklin and Sir C. Quilter at their unavoidable absence, and proposed the toast of the "President, Vice-President, and Board of Directors," with graceful references to Mr. J. S. Forbes, to whom a telegram of greeting was sent. The chairman also welcomed Sir Henry Fowler as president, Sir G. Franklin as vice-president, and Sir J. Woodhouse as director.

Sir H. Fowler, in his reply, paid a debt of praise to his predecessor and to Lord Harris, and eulogised the devoted board of directors and the excellent permanent staff, without which no success can be attained. The situation had been changed by the advent of competition—a competition of efficiency for the good of all. In the present boom in telephony, which cannot be adequately met by either the company or the Post Office, every effort must be put forward to make the service the best, most efficient and convenient.

Speaking to the toast of the "National Telephone Company," the chairman said the number of exchanges had increased during the year from 999 to 1,025, and the subscribers by 20,000 to 226,000—1 in 183 of the population of the United Kingdom. The number of messages during the year was 787 millions, an increase of 75 millions; according to the latest returns, the Post Office telegrams numbered 89 millions, a *decrease* of 838,000. The cheaper services had been greatly developed, and there were now nearly 30,000 subscribers served at an average rate of £4 18s. per annum on the message-rate and party-line systems about 6,000 of these are on the latter, or "omnibus" system, paying only £3 per annum. Referring to the competition in Glasgow, Mr. Gaine said that his apprehensions of last year were removed. The Corporation had begun with a system which the company was leaving off, and the company's Glasgow system was now almost perfect. If the competition were to be one of efficiency, there could be no doubt as to the result. His last year's prophecy, that the competition in London would be reduced to the attempt to give the best service, had proved correct, and he would again prophesy, while asking for a further two millions capital a year, that the present restrictions on the company's development would be removed, so that it could develop as it should and would.

Lord Harris, in reply, said that the lion had lain down with the lamb; the questions arose whether the lamb could lie as well as the lion, and where would the lamb be lying in the course of a few years? If the competition between the company and the Government were one of "brains," he had no fear as to the result; a company can improve its apparatus, where a Government dare not experiment. Lord Harris referred with sympathy to the patient operators, who had much to put up with. The toast of "Our Guests" was proposed by Mr. J. W. F. Ashwin, and responded to by Sir J. Fergusson; Prof. Silvanus Thompson also replied, and spoke approvingly of the union of science with commerce, which hastens the progress of both. As an instance, he had that morning received details of an application of telephonic apparatus to wireless telegraphy by an Italian, Castelli, whereby the range of transmission was enormously extended; the device had been in operation in the Italian Navy for six months. The toast of "The Chairman" brought the official proceedings to a close.

Royal Society.—Yesterday the following papers were read:—"On some Phenomena Affecting the Transmission of Electric Waves over the Surface of the Sea and Earth," by Capt. H. B. Jackson, R.N., F.R.S. "Microscopic Effects of Stress on Platinum," by T. Andrews, F.R.S., and C. R. Andrews. "A Note on the Re-Crystallisation of Platinum," by W. Rosenhain. "On Electromotive Waves Accompanying Mechanical Disturbance in Metal Immersed in Electrolyte," by Prof. J. C. Bose.

Obituary.—We regret to learn of the death, at the age of 68 years, of Mr. George Griffith, who has for the past 12 years most courteously and indefatigably filled the office of secretary of the British Association for the Advancement of Science. Mr. Griffith's connection with the Association dates back over a period of 40 years, during which time he has rendered excellent service thereto in connection with the yearly congresses.

(*Continued on page* 821.)

THE MANUFACTURE OF GLOW LAMPS.

(Concluded from page 777.)

The operations of glass blowing are fascinatingly interesting to watch, but their charm disappears when reduced to black and white. Suffice it to say, therefore, that such bulbs as are hand-made are blown from tubes of flint-glass, of a special composition, suitable for uniting with platinum. Only special and odd sizes of bulbs are made at Brook Green, which is not a glass-works, the bulk of the bulbs being blown in moulds at another factory.

Each bulb on receipt has a small tube attached to the top end of the bulb, which serves as a handle, by means of which the glassblower manipulates it; the neck of the bulb is deftly prepared, the filament inserted in its correct position, and the neck pinched down upon the platinum wires. This sounds easy, but it is, in fact, one of the most crucially important operations of all. Unless the seal is permanently airtight, both when hot and when cold, the vacuum will deteriorate, and the lamp will go off in a decline; cheap foreign-made lamps are defective especially in this particular. The best British lamps, however, are provided with a very long seal, so as to quite do away with the risk of leakage. In this lies one of the chief reasons why good British lamps cost more than the cheap and inferior importations frequently met with; not only is a greater amount of platinum required, but the operation of sealing-in takes many times as long as the less efficient method.

Briefly, the process is as follows:—The end of the neck is opened by heating it and blowing into the bulb; the filament is then inserted, and the wires held against the edge of the opening while they are heated to redness, when they adhere. The glass is then further heated, and pinched down round the wires so as to grip them tightly, and the seal is finished off with deft manipulation of the blow-pipe. To hold the cap on, two little lugs of glass are welded on at the sides of the seal. Directly the process is finished the lamp is placed in a red-hot crucible, forming one of 20 mounted on a frame, which can be rotated so as to bring any one of them over a Bunsen burner. As each lamp is finished and placed in the hot cup, the next cup is moved over the burner, and the newly finished lamp is left to anneal as the cup slowly cools.

From this operation the lamps pass to the pump room, where they are connected in groups of five to the pumping apparatus. Each lamp is separately sealed, by means of the attached tube, to a glass "fork," using a tiny blow-pipe flame for the purpose. The greater part of the air is then exhausted by means of mechanical pumps, after which the vacuum is raised to the necessary degree by means of Sprengel pumps. As the latter work in the partial vacuum of the mechanical pumps, they are of the shortened form, which suffices for completing the exhaustion. Each filament is raised to incandescence during the later stages of exhaustion, in order partly to drive off occluded gases, and partly to more completely carbonise the filaments, thereby driving off other gases and diminishing the liability to injury through possible over-running in actual use. To ensure this result, the lamps are at this stage run up to a pressure 50 per cent. higher than that at which they are to run eventually. To drive off the film of air which adheres to the inner surface of the glass, an asbestos box is lowered over each group of lamps, and a Bunsen burner is lighted beside them, so as to maintain them at a high temperature. The usual chemical means are adopted to dry the air in communication with that in the bulbs.

General View of Sealing Room (Brook Green Lamp Works).

At the conclusion of the pumping process the lamps are removed by fusing the glass at the tip of the bulb, which at the same time seals up both the lamp and the tube connected with the pump. The lamps are next tested by hanging them on contacts arranged in rows, and running them up to 50 per cent. above their rated voltage. The

experienced eye of the operator readily detects any important defect in the filaments or in the vacua. The latter are further tested by means of an induction coil, each lamp,

Part of a Bench in the Pumping Room.

held in the hand, being momentarily applied to one of the terminals of the coil. If the vacuum is bad, a blue glow will appear throughout the interior of the lamp; if good, no glow at all will appear.

Having passed this test, the candle-power and efficiency are measured. This process is carried on very quickly, thanks to constant practice. Every lamp is tested at a standard efficiency of 4 watts per candle, the candle-power and voltage at this rate being marked in ink on the bulb; the lamps are afterwards sorted into their respective classes. The photometer used is a simple Joly screen, with a direct-reading scale; the standard is a Vernon-Harcourt pentane flame, with Methven screen. The operator is seated with the photometer head before her, and makes the necessary adjustment by means of a rack and pinion, which moves the lamp under test. The scale of the photometer and that of a wattmeter are close together in front of her, and near the screen, so that she can readily ascertain the candle-power and compare it with that corresponding to the power absorbed. If the candle-power is not four times the watts, the operator varies the voltage until the two values are in agreement; an assistant then reads the voltage, and marks it, together with the observed candle-power, on the bulb. The lamps are carefully hidden by means of screens from the direct vision of the operator, so as to affect her sight as little as possible; one of these screens is absent from our view on p. 819, which represents the interior of one of the many photometer rooms, specially lighted up for the purpose of taking the photograph.

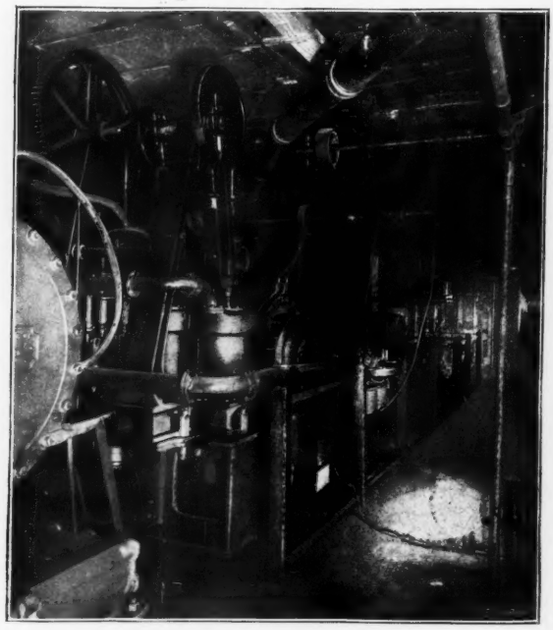
Having passed this test, most of the lamps now go to the capping room—the demand for "bottom-loop" lamps is insignificant, and even the Admiralty, which preferred to use this type with spring holders to prevent injury from vibration when firing heavy guns, is now specifying capped lamps.

All the high voltage "Robertson" lamps are capped with vitrite; the remainder are fitted with brass caps, mainly of the bayonet joint type. The only feature of this process calling for special mention is the cement employed for attaching and filling the caps. Ordinary plaster of Paris is open to many objections; it is neither damp nor heat proof, and if not carefully used, is apt to retain moisture, leading to disastrous consequences. The Incandescent Electric Lamp Company use a cement which is the antithesis of plaster of Paris, except, perhaps, in colour; it sets slowly, and is improved by heating; it is extremely hard when set, quite damp proof, and an excellent insulator. Its manipulation seems to be very similar to that of plaster. One of our views shows the room in which the process is carried on.

The last operation upon the lamp, exclusive of packing, is another test—an optical test, to detect any defect which may have escaped notice in previous examinations, and to weed out lamps which may have been accidentally packed with others of a different voltage. After this the lamps are cleaned and dried, wrapped in paper and packed in cardboard tubes, which are assembled in boxes and placed in store. Glow lamps are things which must not be delayed in delivery; hence an enormous number has to be kept in stock, amounting in the case of the Brook Green Works to as many as three-quarters of a million. It may interest readers to know that approximately 2,000 different classes of lamps are necessary to make a lamp maker's stock anywhere near complete.

A certain proportion of obscured lamps are asked for; these are prepared by means of a sand blast, as lamps obscured in this way give better results than those roughened with acid.

The mechanical pump room, of which we give a view, contains several pumps of different kinds, which



Mechanical Pump Room.

are constantly at work, driven by a horizontal engine. The speed is controlled by a small mechanical watchman,

which rings an electric alarm when the speed varies in either direction beyond a pre-arranged limit.

Lastly, we have shown that elaborate precautions are taken to *prevent* fire; not content with this, the company have made provision for the speedy extinction of fire should any

Brook Green Works: Testing Benches.

occur. A number of employés have been thoroughly drilled as firemen, and form a very efficient brigade; on p. 820 we give a view of them, standing in front of the fire station, which is equipped with self-opening doors, and the necessary hose-lines, helmets, axes, &c. Directly an alarm of fire is signalled, and the steam hooter sounded, the brigade assembles instantly, and unfailingly accomplishes the object for which it was inaugurated. The system is one which is highly commendable. That the staff is efficient is proved by the fact that it barely failed, by an accident, to secure the championship at the competition in London last year—coming out third in order of merit.

The Incandescent Electric Lamp Company have adopted, for several years, the enlightened policy of welcoming visitors to their works, to which they attribute to some extent their undoubted success. Truly, no one could examine the various processes and tests without becoming convinced that the "Robertson" lamp is made with a view to attaining the highest standard of workmanship and efficiency.

MODEL CONDITIONS FOR ELECTRICAL CONTRACTS.

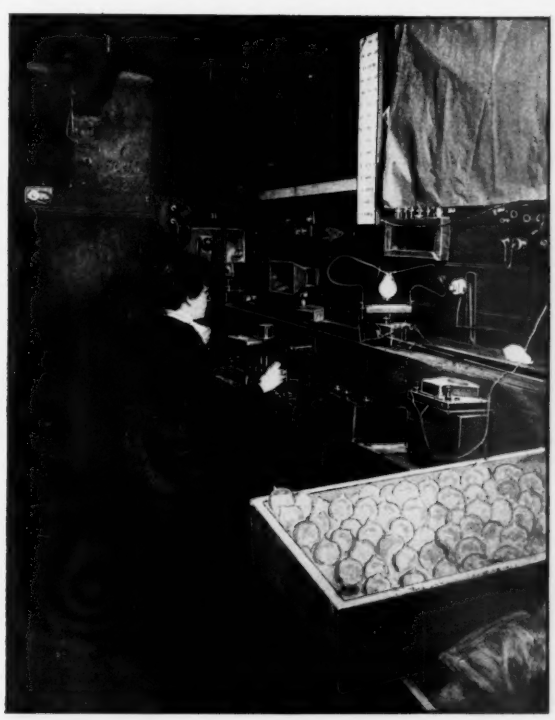
The model general conditions for electrical contracts, proposed for adoption as standard by the Council of the Institution of Electrical Engineers, were further discussed at last week's meeting of the members of that Institution. There was a large attendance, and the keen interest manifested in the proceedings should convince the Council that in guarding the general interests of the industry, they are fulfilling what, in the opinion of the general body of members, is one of their primary functions.

It is satisfactory to note that Mr. Hammond, speaking on behalf of the Committee to whom the Council delegated the duty of preparing this draft, welcomed the criticisms their issue had called forth, and promised that the suggestions made should be fully considered before the final draft was prepared. He asked, further, that any members not able to speak, but desirous of expressing an opinion on any of the clauses, should, as soon as possible, send their communications in writing to the Secretary of the Institution. It will be well for the industry if this advice is acted upon, so that the Committee may have at their disposal the views and opinions of all who are actively interested in the important question of fair and equitable general conditions being embodied in the final draft.

It will be remembered that at the previous meeting Mr. Nisbett criticised the wording of the first 20 clauses, pointing out how, in his opinion, the interests of the contractor had not been sufficiently safeguarded. On being invited by the President to continue his remarks, he pointed out that Clause 21, dealing with the manner of execution of the work, with its reiteration of the word "best," was too binding. The next clause, dealing with the powers of the engineer to vary the work to be done under the contracts within the limits of *10 per cent.* of the contract amount, he thought might be amended to advantage in requiring the purchaser to pay for the patterns of goods manufactured specially for the contract and not "taken delivery of," so to speak.

Clause 27 provides that no plant or materials are to be forwarded until instructions to do so are given by the purchasers, and that if such instructions are held back the purchaser shall pay the cost of storage, in addition to making payments as if delivery had been taken. Mr. Nisbett pointed out that as worded this might delay the final payments, and suggested that in addition to storage expenses, interest at the rate of *5 per cent. per annum* be paid on all payments, deferred beyond the dates anticipated by the contract.

Referring to carrying out the work to the entire satisfaction in every respect of the engineer, the speaker thought the rights of the purchaser would be amply met if the words "reasonable satisfaction" were substituted. It would seem to be fair to limit the liabilities of the contractor in case of accident by excepting the period during which the purchaser was having beneficial use of the plant, unless it could be proved that the accident was due to defective workmanship



Brook Green Works: One of the Photometer Rooms.

or material. The "terms of payment" clause came in for severe comment. It did not sufficiently provide for those cases where material was delivered only, or give the contractor the

right to charge interest on instalments which for any reason were not paid, although the engineer's certificate for the same had been obtained and handed in.

Mr. Nisbett concluded by objecting to the sentence in the form of agreement binding the contractor to supply whatever "*may*" be necessary to complete the work, as he considered the specification ought to mention all that was included in the contract. He further stated that his examination of the clauses had shown him 57 points guarding the interests of the purchasers as against 17 in favour of the contractor.

Brook Green Works: Capping Room.

Mr. Stuart Russell pointed out the inconsistency caused by the limits of time for the preparation of the contact and bond being *30 days* in some portions of Clause 10, and *one month* in others, and also that in Clause 13, although the contractor has a time limit within which he must supply the contract drawings, there is no corresponding limitation on the engineer. He may, under this clause as worded, delay his approval, and cause the contractor great inconvenience and loss. In one instance recurring to his memory, an engineer took a long time to consider and approve a pipework arrangement, with the result that the contractor found the prices of materials had increased no less than *30 per cent.*

The payment clause needed revision; at present there were doubts as to when the various instalments actually became due. He thought it was of the utmost importance that there should be no ambiguity on this point. In Clause 40 it was stipulated that in cases of late delivery, certain penalties were to be inflicted; in Clause 13 it was open to the purchasers to demand from the contractors any expenses they might have been put to by reason of late delivery of drawings. Mr. Stuart Russell asked was this equitable? If the contractor completed his work within the stipulated time he had fulfilled his contract; if not, had he to pay penalty twice?

Mr. Hawkins desired the arbitration clause to be amended, as he feared in its present form it might not have unlimited application. He also considered that the contractor's liability as regards insurance against risks should be limited to the value of his own contract. The present wording of Clause 33 did not, in his opinion, safeguard him against contingent risks for which he ought not to be held liable. For instance, if he supplied a switchboard, ought he to insure the whole station? With regard to tests, the clauses permitted the purchaser to demand two tests of the same plant or apparatus; surely this was unnecessary.

Mr. Kingsbury thought that these clauses were a great advance upon present day practice. He despaired of getting anything absolutely just in this connection, but in this case the rights of the contractor had evidently been considered, and that was a great point.

Mr. Shoolbred considered that the duties and privileges of the engineer had not been sufficiently appreciated by the Committee. He acted as the adviser to the purchaser, and the exponent of his wishes to the contractor. Was it not possible that the purchaser might consider the clauses dealing with drawings and their approval by the engineer, in their present form derogatory to the dignity of the latter?

Mr. Esson was decidedly of the opinion that the draft now presented was more suitable for building than for electrical plant contracts. The clauses referring to use of crane and access to site should be included in the specification, not in the general conditions. The clause relating to patents needed considerable modification in the direction of limiting the liabilities of the contractor to patents embodied in the design of the article supplied and not to the manner in which it might be used. He thought that Clause 24, dealing with the consequences on the carrying out of the contract of the death or bankruptcy of the contractor should be amended to include, also, the purchaser. It should be competent for the contractor to obtain, in the event of the death or bankruptcy of the purchaser, a certificate from the engineer enabling him to rank as creditor to the full value of the work already carried out by him in any partially completed contract. He concurred with Mr. Nisbett in his remarks upon the terms of payment clause, and further thought that if it became necessary to grant extension of time for completion of the contract through causes well known to all parties, the engineer should grant an extension of time without the onus of applying for the same being placed upon the contractor.

Mr. Gray thought the draft clauses as presented were a very fair attempt to reconcile the opposing interests of purchaser and contractor, and Mr. Yeaman considered that in the case of contracts involving small alterations to existing foundations, it would often be found advisable to include these in the contract. He further thought it would be far better to stipulate that the details now left open for arrange-

Brook Green Works: Fire Brigade and Station.

ment after the signing of the contract at the interview between the engineer and the contractor, should be definitely settled before the contract was finally sealed.

NOTES.

(*Continued from page* 816.)

Students of the Institution of Civil Engineers.—The 27th annual dinner was held at the Restaurant Frascati on Friday, the 9th inst., Mr. Charles Hawksley, President of the Institution, being in the chair and supported by Sir Alex. Binnie, Dr. Kennedy, Capt. Sankey, Dr. Tudsbury, Prof. Perry, and Messrs. Bradley, Kelly, Henderson, and Wimperis. The success of the dinner and the quality of the speeches were quite up to those of previous years, and an excellent musical programme had been arranged by Mr. L. H. Ruyg. The chairman proposed the loyal toasts, and after these had been duly honoured, Mr. H. E. Wimperis proposed the toast of "The Institution, Secretaries of the Institution, and Our Guests," and referred to the benefit which might be derived from the establishment of more engineering scholarships. The chairman, in replying to the toast, commented upon the advantages gained by the entrance examination for students and associate members, and the great social benefits which students might derive from the visits and meetings arranged for them. Sir Alex. Binnie proposed what he considered to be the toast of the evening, "The Students." He said that to become a successful engineer it was necessary to have sound self-reliance, a love for the profession, and to study thoroughly the resources of Mother Nature. Mr. H. W. FitzSimons, the secretary of the Students' Dinner Committee, replied, and thanked the President and Council for the interest they took in the students' proceedings. Then, with the remainder of the musical programme, the National Anthem and Auld Lang Syne, the proceedings were brought to a close.

The Proposed Embankment Electric Tramway.—The Committee of the House of Commons, of which Mr. H. Hobhouse is the chairman, continued consideration of the London County Council (Tramways and Improvements) Bill on Monday, and

Sir J. Wolfe Barry, consulting engineer to the Metropolitan District Railway Company, said that for 1¼ miles the proposed Embankment tramway would follow the course of the District Railway. For about 740 yds. it was proposed to construct the tramway immediately over the railway tunnels. The roof of the tunnel was supported by cast-iron girders upon brick arches. The tunnels were constructed 30 years ago, and even at the present time are very highly strained. He viewed with extreme anxiety the imposition of the extra weight of rolling cars. He knew from examination and calculation that the girders were now subjected to heavier strain then they were intended to bear. The weight of road metal as well as traffic had greatly increased since construction. The proposed tramway would necessitate reconstruction of the tunnels. This would be a dangerous and expensive work, so critical and difficult that he would not like to undertake it except under absolute necessity.

Surely Sir J. Wolfe Barry has not walked along the Embankment during a period of road repairing, or he might have seen, for weeks at a time, a number of very heavy steam road rollers, sometimes moving along three abreast. If the thought of electric cars makes him extremely anxious, these road rollers should have occasioned incipient mental aberration. The bathos, too, of Mr. Blennerhassett's argument that electric cars would vulgarise and disfigure a thoroughfare of which all London was proud, and destroy it as a place of recreation and quiet for the poorer classes, is too utterly ridiculous for serious comment, but it is high time that this sentimental dragging in of the poorer classes on the slightest pretext should be protested against. Let Mr. Blennerhassett spend a Sunday on the Thames Embankment and observe the kind of quiet and recreation the poorer classes indulge in during certain hours. We should be more inclined to call the thoroughfare of which London is so proud a "bear garden." Fancy a trim electric car vulgarising the youthful male and female Hooligan of the Thames Embankment! Ye gods!

Luckily, however, the Committee unanimously came to the conclusion to authorise the tramway so far as the point at which it would form a junction with the tramway authorised a fortnight ago —that is to say, from Westminster to Waterloo Bridge.

Coronation Energy.—Worthing — Mr. G. Porter, resident engineer, sends a printed form stating that the Corporation will supply electricity for illuminations at cost price, viz.—1s. 4d. per night for 50 8-c.p. lamps, and *pro rata*. The supply is to be taken between 9.0 p.m. and midnight, or an extra charge of 6d. per hour per 50 lamps will be made. Fourteen days' notice, and the cost of temporary services, are also specified. The municipal buildings will be illuminated.

Sheffield.—Mr. S. E. Fedden says that for a special connection, the charge will be at cost, this charge to be refunded if the supply becomes permanent within three months. 1d. per 8-c.p. lamp per night up to midnight, will be charged.

Electric Traction at 3,000 Volts.—Messrs. Ganz and Co, of Buda-Pesth, says *l'Industrie Electrique*, have recently established at Neustadt, near Vienna, a system of electric traction with three-phase alternating currents at 3,000 volts, with a frequency of 42 cycles per second. It is used to connect the Government Arsenal at Wollersdorff with the Schneeberg Railway, a length of 800 metres, over slopes too steep to permit of horse traction, and the service is too irregular and light to render the use of a steam locomotive kept always under steam economical. The Arsenal possessing already a three-phase plant of 3,000 volts, it was decided to make use of this without conversion. The service is carried on by means of a locomotive of 36 kw., driving the wheels by gearing, reducing the speed in the ratio of six to one. The induction motor is started and stopped by means of a liquid resistance introduced into the circuit of the rotor, which gives very smooth starting. The current is collected at 3,000 volts from two overhead wires by means of bows, the return circuit being formed by the rails. The controller is operated by compressed air, and all the details of the locomotive reproduce on a small scale the arrangements proposed by the Ganz Company for the electric railway of Valtellina. The line, which has been running for some months, gives every satisfaction, and seems to show that the use of polyphase currents at 3,000 volts for electric traction is to-day a practical application, as well as being simple and economical.

A New Law in Magnetism.—At the general meeting of the American Philosophical Society last month, Prof. M. I. Pupin, of Columbia University, New York, in a paper on "The Law of Magnetic Hysteresis," presented an account of a mathematical and experimental research upon the magnetic properties of iron which resulted in the discovery of a new law in magnetism. This law can be stated as follows:—"The heat generated per unit volume of iron during a cycle of magnetisation is proportional to the cube of magnetic intensity." This law holds true within the first of the three well-known intervals of magnetisation. It was discovered by determining accurately the resistance of the magnetising helix, employing vibratory magnetising forces of about 1,000 periods per second, and then separating the various components of this resistance by means of mathematical analysis. This investigation is an extension of the researches of Prof. Ewing, of Cambridge University, England, and of Lord Rayleigh, employing a new and very much more sensitive method. Its results have a very important practical bearing on the manufacture of inductance coils. From its purely scientific aspect the new law derives its principal interest from the fact that it will materially assist in the formulation of the physical theory of magnetism."—*Science*

Institution of Electrical Engineers.—The Glasgow Local Section has appointed the following office-bearers for 1902—3:—Past chairmen, Lord Kelvin, G.C.V.O., &c., &c; Magnus Maclean, D.Sc.; chairman, Henry A. Mavor; vice-chairman, W. A. Chamen; hon. secretary and treasurer, E George Tidd; ordinary members of committee, J. M. M. Munro, W. B. Sayers, Thomas Young, A. R. Bennett, M. B. Field, William M'Whirter, A. Gray, LL.D., M. T. Pickstone, D. Stewart (representing associates).

Gas v. Electricity.—We cannot claim to look at this question from an outside point of view, and therefore our opinions may be suspected of bias; we do emphatically claim, however, that we endeavour to see fair play accorded to both sides, in whatever controversy, and the outrageous statements in the speech which we quote below (from the *Mechanical Engineer*) leave us breathless:—"At the annual meeting of the Institution of Gas Engineers, recently held in London, Mr. T. Holgate, president, in the course of his address, referred to the subject of gas and electricity. He said while gas could furnish all the essentials with economy, electricity could only offer the advantages of portability and beauty of appliance, but purchased, of necessity, at a cost that was extravagant. Power from electrical motors was four times the cost of power from a gas engine, and the consumer who wished to have the electric light could produce it on his own premises by means of a gas engine at a cheaper rate than he could buy it from the electric supply companies. The most successful application of electricity was that to tramcar propulsion, not because it was cheaper, but because of the smoothness of running." We have no hesitation in absolutely contradicting every one of these statements —the last especially—and it is impossible for the speaker to prove them.

That Motor-Car Policeman.—Mr. Vincent S. Allpress, of Messrs. Massey & Allpress, recently came off victor in a conflict of evidence as to the speed of a motor car at Farningham. The case was heard at Dartford, two police officers being positive that the car covered 350 yards in 35 seconds. As the journey from Eltham to Farningham occupied over an hour for a distance of 9 miles, it was contended for the defence that the speed was not excessive, and as the magistrates did not consider that the accuracy of the methods of speed observation adopted by the police had been proved to their satisfaction, the charge was dismissed. We congratulate Mr. Allpress on having upset the crude methods of police measurements of speed, but many other gentlemen travelling simply for pleasure, and well within the 12 miles an hour limit, have not been so fortunate.

The Accumulator Industry.—The *Centralblatt f. Accumulatoren und Elementenkunde* of March 15th, contains an interesting article by Dr. A. Pfaff upon the development of the secondary cell manufacture. After passing in review all the changes which have taken place in the design and structure of accumulators since the first appearance of the Planté type of cell, Dr. Pfaff concludes by drawing attention to the part which competition between rival firms of secondary cell manufacturers has played in this development of the industry. Each firm has devoted time and money to the improvement of its special form or type of cell, and has realised that its very existence as a producing firm, has depended upon its ability to continually improve the efficiency or life of its cells. Few who have studied the history of the accumulator industry will deny the truth of Dr. Pfaff's observation. Competition has necessitated research directed towards improvements, and research on these lines has been followed by progress and benefit to

both the manufacturer and the consumer. Dr. Pfaff's remark might indeed be applied without leading one astray to all branches of the electrical industry. It is precisely the firms which are spending most money on research work that to-day stand highest in public favour. The Nemesis that overtakes those firms which rest on their oars and base their trading on patents and designs of ancient date, has recently been illustrated very forcibly in our own country. Fortunately we possess electrical manufacturing companies of a more advanced type, and recent occurrences will no doubt emphasise the necessity for constant efforts to keep in the first rank as regards the march of progress and invention.

Personal.—Mr. L. Johnston, who has been for the past five years in the traction department of the British Thomson-Houston Company, has accepted an appointment with the British Electric Traction Company.

Mr. H. M. Salmony has sold a large share of his interest in Julius Sax & Co., and resigned his directorship. He now intends devoting himself to the purchase and sale of patents, for which his connections in electrical and financial circles should stand him in good stead. Though not styling himself "consulting electrical engineer," he offers his services as adviser to manufacturing firms in a commercial aspect. His address is 95, Mortimer Street, Cavendish Square, W.

Mr. J. Newton Stephens, engineer and manager of the North of England branch of the National Electric Wiring Co., Ltd., is resigning that position to take up an important appointment on the staff of the Electric Lighting Boards, British Manufacturing Co., Ltd., of London.

Requiescat in Pace.—The ill-fated cable ship *Grappler*, which went down with all hands during the terrible volcanic eruptions at Martinique, was often to be seen in the Thames, and many is the time we have been on board the sturdy little vessel when she was taking out cable for the company which owned her. To the relatives and friends of those who, in the execution of their duty, and without a moment's warning, were sent to their last home, we offer our heartfelt sympathy.

Proposed New Electrical Works.—At the offices of Messrs. Armitage & Norton, Huddersfield, on 13th inst., a meeting of business men was held to consider a proposal by an Austrian firm, to establish in the borough a factory for the production of electrical machinery, colliery and ironworks appliances new to this country, motors, generators, cars, fittings, &c., under a limited liability company, with a capital of £120,000. The Mayor of Huddersfield and other members of the County Borough Council, and public men, were present at the meeting, which was also attended by Mr. Kolben, of Prague, on behalf of the firm alluded to, and by Messrs. Witting Bros., of London, the agents of the firm.

Mr. W. H. Armitage gave the details of the scheme, and stated that Messrs. Witting would subscribe £20,000 of the proposed capital. The remainder would have to be raised locally. Employment would be given for 500 workpeople. It was also announced that Sir John Ramsden, Bart., the ground landlord, would grant a site for the works on favourable terms, and would put £5,000 into the undertaking if the remainder of the capital were subscribed.

Messrs. Witting Bros. and Mr. Kolben explained the advantages of the scheme. Mr. Witting said that some favourable conditions of labour on the Continent would be equalised by other favourable conditions in England. He also stated that, in his opinion, the new works, if established, would pay a profit of 10 or 12 per cent.

Mr. Kolben produced plans of the proposed works, and said that one great advantage would be that the new company would have all its plans, models and patterns, to start with.

A committee was formed to make further inquiries into the scheme, and to take every precaution to obtain sufficient guarantees that it shall be permanent and profitable, and report to a public meeting. The committee further discussed the scheme with Messrs. Witting Bros. and Mr. Kolben on 14th inst. At present Huddersfield is almost wholly dependent upon its woollen cloth manufacturing industry, and the proposed works would prove of much benefit to the town. There is every probability that the capital required will be forthcoming, other things being, of course, satisfactory.

American Exports Declining.—A Central News telegram states that for the 10 months ending April 30th American exports show a decline of 70¼ million dollars as compared with the year before. The imports increased 78,392,920 dollars.

Correction.—We understand that the electrical work at the Cork Exhibition was carried out to the design of Mr. Nalder, chief engineer of the Tramway and Lighting Company; Mr. Cutler, as City engineer, had charge of the civil engineering work.

Appointments Vacant.—An assistant is wanted for Leicester at a salary of £135; the Corporation of Newport wants a borough electrical engineer and tramways manager; a resident engineer is required at St. Annes-on-Sea at £175; the Portsmouth Corporation wants a resident electrical engineer for tramways at £200 per annum. See "Official Notices" to-day.

Parliamentary Committees.—The preambles have been proved of the Bills relating to the following:—Baker Street and Waterloo Railway, L.C.C. Tramways, and Croydon Tramways.

The Shawanigan Falls Power Scheme.—An account of this new power generating station, belonging to the Shawanigan Water and Power Company, has lately been published by Mr. F. C. Perkins in an American journal, from which we extract the following particulars. The Shawanigan Falls are on the river St. Maurice, about 20 miles north of the town of Three Rivers, which stands roughly midway between Quebec and Montreal on Lake St. Peter. The river St. Maurice is about 400 miles long, and collects its water from numerous streams and lakes which represent a total watershed of some 17,700 sq. miles. Near the falls the amount of water passing is about 26,000 cub. ft. per second, which should suffice to raise 100,000 H.P., as the height of the natural fall is 114 ft. The power station receives its water through a canal 300 yards long, 90 ft. wide, and 18 ft. deep, which conducts it to a reservoir having a dam 36 ft. high and 27 ft. thick. From there, tubes, six of which have been arranged for, and three already installed, 8 ft. in diameter, conduct the water to the turbines, the fall of water to the factory level being 117 ft. The canal has a capacity of 60,000 H.P.; the reservoir of 30,000; the station itself will be large enough to develop 15,000, 10,000 being already in operation or in process thereof. At present there are two turbines of 6,000 H.P. at 135 ft. head of water, built by the I.P. Morris Co., of Philadelphia, and two dynamos of 5,000 E.H.P. supplied by the Westinghouse Electric and Manufacturing Company, of Pittsburg. The power house is of sufficient size for the erection of a third generating unit; while an additional building has been allowed for, which will enable the plant to be increased to six units of equal dimensions. At a distance of half a mile from the main station, where the rivers Shawanigan and St. Maurice approach one another, and where there is an available difference in water level of 135 ft., a subsidiary plant has been erected, capable of developing 15,000 H.P., all of which is required by the Belgo-Canadian Pulp Company. A dam, 36 ft. high, has been built from which a steel tube 200 ft. long conducts the water to the turbines, after which it travels through a 200 ft. tunnel into the St. Maurice. The tube is 8 ft. in diameter by 8 mm. thick at its inlet, increasing to 11 ft. by 14 mm. at its mouth. Twin turbines are used here, the water entering radially and escaping axially. Among the employments found for the vast amount of power mentioned above, 15 towns are to be supplied with electric light and power—in fact, the charter of the company includes the whole of Quebec province—35,000 H.P. are to be shared between the new aluminium factory of the Pittsburg Reduction Company, the Shawanigan Carbide Company, and (apparently) some other calcium carbide factories; while probably alkali, bleach, and chlorate will also be manufactured in the future by some of the remaining energy.

Acetylene in Mining.—Acetylene is being somewhat extensively used on the Continent for the illumination of mineral mines, and even such coal mines as are known to be free from explosive gases. In some respects the gas has an advantage over electricity, owing to the greater portability of the lamps, which enables them to be shifted into the best positions in the workings, and also owing to the absence of conductors, which are occasionally liable to injury. The lamps will burn satisfactorily in a strong draught, as the gas issues from the generator at a higher pressure than oil from a wick; and they are stated to bear an atmosphere vitiated with carbon dioxide, or deficient in oxygen, better than those consuming rape oil, while they are certain to go out long before any dangerous quantity of methane can reach them. Of course, in explosive coal mines, electric lamps are far better, in fact, the best form of illumination of all; because the Davy really gives a very poor light at the best of times, and the heat evolved during the combustion of acetylene is so great that the gas does not lend itself to the construction of a safety lamp on the Davy principle—it tends to make the gauze red hot and so capable of starting an explosion, while its flame will not act as an indicator of marsh gas.

THE CENTRAL STATION ENGINEER.

The assistant engineer of the Blackburn Tramways, Mr. C. Barber, who has been appointed to the position of works engineer and traffic manager of the Bournemouth Corporation Tramways, before leaving Blackburn, was presented by the staff and employés of the tramways department with a gold albert, silver cigarette case, &c. Mr. Giles, in making the presentation, spoke very highly of the way Mr. Barber had carried out his duties, and of the great esteem in which he was held by all the staff.

At a smoking concert held at the Zetland Hotel, Middlesbrough, on May 7th by the staff of Middlesbrough Corporation Electricity Department, Mr. Harold W. Clayden, the late borough electrical engineer, was presented with a handsome chiming travelling clock on the occasion of his marriage and leaving to take up a new appointment in South Africa. The presentation was made by Mr. W. Telford, the chief assistant engineer, on behalf of the staff, and Mr. Clayden, in responding, thanked the staff for their kindness shown to him during his residence in Middlesbrough, and for the assistance they have given him in placing the electricity undertaking in its present prosperous position.

On Friday last the engineering staff and employés of the Manchester Corporation electricity works presented Mr. W. F. Long with a token of their esteem, in the shape of a handsome dressing case, prior to his leaving to take up the important position of chief electrical engineer to the Corporation of Capetown. The presentation was made by Mr. S. L. Pearce, the deputy chief engineer, who alluded to Mr. Long's good work in Manchester, and expressed the sincere regret of the staff on parting with him.

NEW COMPANY REGISTERED.

Erimus Automatic Safety Guard Company, Limited (73,661).—This company was registered on May 8th, with a capital of £2,000 in £1 shares, to acquire any patents, inventions, concessions and the like relating to safety guards or other machinery accessories or fittings to electric cars, trolley cars, motor cars, vans, carriages and other road vehicles, to acquire from the Middlesbrough Investments, Limited, T. Jones and H. Bennett the benefit of an existing invention relating to an improved safety guard for tramcars, motor cars and the like, and to carry on the business of tramcar, motor car and vehicle builders and dealers, engineers, electricians, founders, cycle manufacturers, &c. The first subscribers (each with one share) are:—H. Bennett, Eaglescliffe, Co. Durham, inspecting engineer; T. J. Copsewood, Eaglescliffe, Co. Durham, draper; C. Chipchase, Post Office Chambers, Middlesbrough, articled clerk; C. Griffiths, 61, Albert Road, Middlesbrough, coal merchant; A. I'Anson, Post Office Chambers, Middlesbrough, chartered accountant; G. A. L. Hunton, 61, Albert Road, Middlesbrough, Vice-Consul for Portugal; and J. Elliott, 11, Bedford Street, Middlesbrough, clerk. No initial public issue. The number of directors is not to be less than three nor more than seven; the first are H. Bennett, C. Griffiths, A. I'Anson, T. Jones and G. C. Mosses. Registered office, Post Office Chambers, Middlesbrough.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Northampton Electric Light and Power Company, Limited (28,840).—This company's annual return was filed on March 7th, when 10 "A" and 40,722 "B" shares were taken up out of a nominal capital of £50,000 in 10 "A" and 49,990 "B" shares of £1 each. £40,332 has been received. Mortgages and charges, £34,600. (Note.—5,000 shares allotted subsequently to date of above return.)

Eastern Telegraph Company, Limited (6,338 C).—This company's annual return was filed on February 20th, when £5,955,565 had been taken up out of a nominal capital of £6,000,000 in £4,000,000 ordinary stock and £2,000,000 preference stock. The £5,955,565 stock has been paid for in full. Mortgages and charges, £1,534,645.

Newcastle and District Electric Lighting Company, Limited (28,022).—This company's annual return was filed on March 17th, when all the shares were taken up. The nominal capital is £200,000, in 20,000 shares of £10 each. £9 per share has been called up on 10,000, and £2 per share on 10,000 shares, resulting in the receipt of £110,000, in addition to £1,065 paid in advance of calls. Mortgages and charges, £50,000.

Frank Suter & Co., Limited (57,193).—This company's annual return was filed on May 1st, when 2,050 preference and 13,404 ordinary shares were taken up out of a nominal capital of £20,000 in 6,500 preference and 13,500 ordinary shares of £1 each. £1 per share has been called up on 2,050 preference and 3,404 ordinary shares, resulting in the receipt of £5,454. 10,000 ordinary shares are considered as fully paid. Mortgages and charges, £7,000.

Particulars of registered mortgages and charges:—Amount secured, £7,000 in 70 debentures of £100 each; date of resolution of directors creating series of debentures, April 18th, 1901; property charged, the undertaking and property of the company, present and future, including uncalled capital. No trustees.

City of London Electric Lighting Company, Limited (34,406).—This company's annual return was filed on April 21st, when 40,000 preference and 70,595 ordinary shares were taken up out of a nominal capital of £1,200,000 in 40,000 preference and 80,000 ordinary shares of £10 each. £10 per share has been called up, resulting in the receipt of £1,105,950. Mortgages and charges, £700,000.

Particulars of registered mortgages and charges. Date of creation: January 8th, 1902. Amount secured: £400,000 second debenture stock. Property charged: The business and undertaking of the company, present and future (but excluding uncalled capital), subject only to the first charge to secure £400,000 5 per cent. first debenture stock already issued and the premiums payable in respect thereof. Trustees: Electric and General Investment Company, Limited.

Charing Cross and Strand Electricity Supply Corporation, Limited (29,122).—Particulars of registered mortgages and charges:—

Date of cov'ring deed.	Amount secured.	Dates of resolutions creating debenture stock and series of debentures.	Dates of debenture issues.	Amounts of debenture issues.	Property charged.	Trustees.
April 30th, 1901.	£250,000 debenture stock.	April 10th, 1901.	—	—	Various electric light undertakings.	Law Debenture Corporation, and J. Trotter.
—	£200,000 debentures.	May 31st, 1901.	1901. July 31st Aug. 15th „ 14th Sept. 3rd „ 18th Oct. 3rd „ 15th „ 23rd „ 30th Nov. 6th „ 8th „ 19th	£39,400 3,400 12,500 5,300 16,400 1,700 2,600 110,000 2,500 2,800 1,000 2,400	The undertaking and property of the company, present and future.	None.

Chelsea Electricity Supply Company, Limited (20,468.)—This company's annual return was filed on April 9th, when 44,436 ordinary, 6,000 preference, and 500 founders' shares were taken up out of a nominal capital of £400,500 in 74,000 ordinary shares of £5 each, 6,000 preference shares of £5 each, and 500 founders' shares of £1 each. £5 per share has been called up on 37,770 ordinary and 6,000 preference shares, resulting in the receipt of £218,850. £33,850 is considered as paid on 6,666 ordinary and 500 founders' shares. Mortgages and charges, £150,000 debenture stock and £8,800 buildings.

Charing Cross and Strand Electricity Supply Corporation, Limited (29,122).—This company's annual return was filed on April 12th, when 70,000 general undertaking preference, 70,000 general undertaking ordinary, and 40,000 City undertaking ordinary shares were taken up out of a nominal capital of £1,100,000 in 80,000 general undertaking ordinary, 80,000 general undertaking preference, 80,000 City undertaking ordinary, and 40,000 City undertaking preference shares of £5 each. £5 per share has been called up on 70,000 general undertaking preference, and 70,000 general undertaking ordinary shares, resulting in the receipt of £700,000. £200,000 is considered as paid on £40,000 undertaking ordinary shares. Mortgages and charges, £450,000.

SUPPLY STATION ACCOUNTS.

Bradford Corporation Electricity Accounts.

The increase in the sales for traction and private motive power are the marked features of the accounts of the Bradford Corporation for last year. The total increase is nearly a million and a half units, which compares favourably with even the million units increase of the preceding year. Of the total of nearly five million units, about 34 per cent. is taken for private lighting, 26 per cent. for private motive power and 38 per cent. for traction. This shows what an important effect the encouragement of the long-hour motive power business has had on the results of the undertaking, and at least in part accounts for the very low costs of generation.

General Statement.

	1900.	1901.	Inc.
Total capital expenditure ...	£241,410	**£344,586***	£103,176
Number of units sold	3,424,658	**4,901,172**	1,476,514
Number of 30-watt lamps connected	172,741	**207,176**	34,435
Maximum load in KW.	2,742	**3,593**	851
Gross revenue	£38,547	**£46,034**	£7,487
Gross expenditure	£20,502	**£21,434**	£932
Gross profit	£18,045	**£24,600**	£6,555
Average price per unit sold ...	2·49d.	**2·18d.**	—·31d.

* *I.e.*, £350,717 *less* depreciation £6,131.

In accordance with the general practice, we have for last year taken into account only the profit from the subsidiary department controlling the hire of motors and arc lamps. This is obviously a trading department only, and it is not quite accurate to debit its costs against generation, and then compare the totals with those of other undertakings which do not hire motors out, or do wiring The hiring of motors, &c., by itself, gave the following results:—

	In 1900.	In 1901.
Hire revenue ...	£1,471	£2,040.
Sales revenue ...	£389	£489.
Cost	£1,523	£1,604.
Profit	£337	£925.

Deducting from the sum of £925 the cost of the "free lamps" given away (£885), the net profit appears as £40. The revenue changes are as follows:—

Public lamps.	Private lighting.	Motive power.	Tramways.
51 arc lamps of 600 watts each, 58,797 units.	1,656,241 units, charged at 4½d. per unit, less 2½ per cent. discount.	1,297,120 units, charged 2d. for intermittent, and 1d. for continuous use.	1,889,014 units, charged at 1d. per unit.
1901, £487	£36,287		£7,871
1900, £524	£30,980		£3,973
(76,445 units).	(1,461,262 and 933,465 units).		(953,496 units)

Revenue Statement.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Sale of energy	£35,477	2·49d.	**£44,645**	2·18d.	—·31d.
Meter rents	1,078	·07d.	**1,272**	·06d.	—·01d.
Sale of lamps and hire of motors, &c.*	1,988	·14d.	**112**	·01d.	—·13d.
Sundry rents and fees ..	4	·00d.	**5**	·00d.	·00d.
Gross revenue ...	£38,547	2·70d.	**£46,034**	2·25d.	—·45d.

* In 1900 including gross revenue from hire of motors and arc lamps: in 1901 only the *profit* from this source.

The public lighting sales and revenue have fallen. For the last four years the general figures are:—

	Units generated.	Private supply.	Public lighting.	Tramways.
1898 ...	1,568,459	1,184,996	32,291	202,019
1899 ...	2,858,841	1,738,844	59,004	618,282
1900 ...	4,141,284	2,394,717	76,445	953,496
1901 ...	5,572,294	2,953,361	58,797	1,889,014

And for the last two years:—

	Plant installed. Kilowatts.	Maximum loads. Lighting.	Traction.	Total.
1900 ...	3,600	2,275	467	2,742
1901 ...	4,380	2,930	663	3,593

Repairs have fallen not only in the per unit column but also in the gross. With sundry small changes the works costs are reduced by nearly ½d., and, if we exclude the last item of other expenses for reasons mentioned above, the total cost is lower by practically ¼d. with the figure just over 1d. per unit.

Cost of Production.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Coal	£5,976	·42d.	£7,947	**·39d.**	—·03d.
Oil, waste, water, and engine room stores.	881	·06d.	1,360	**·06d.**	—·00d.
Salaries and wages incurred in generation and distribution and attending street lamps.	2,724	·19d.	2,977	**·15d.**	—·04d.
Repairs and maintenance of engine, boilers, dynamos, buildings and street lamps	4,240	·30d.	3,899	**·19d.**	—·11d.
Works costs ...	£13,821	·97d.	£16,183	**·79d.**	—·18d.

Rent, rates and taxes ..	1,903	·13d.	2,036	**·10d.**	—·03d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	1,546	·11d.	1,723	**·08d.**	—·03d.
General establishment charges, stationery and printing, law charges and insurance.	1,029	·07d.	1,329	**·07d.**	·00d.
Other expenses*	2,203	·16d.	163	**·01d.**	—·15d.
Total costs ...	£20,502	1·44d.	£21,434	**1·05d.**	—·39d.

* Including, in 1900 only, the "maintenance of arc lamps and motors on hire."

As the increase in output brought in a revenue exceeding that of 1900 by £7,487, and the costs only rose by £932, the gross profit is benefited to the extent of £6,555, which reflects great credit on Mr. Chattock's management. From this increase the financial charges take £4,868, leaving as surplus £1,687 to raise the profits of the previous year from £2,731 to £4,418, and this sum together with the former has been placed to the depreciation account, as indicated in the "General Statement."

PROFIT STATEMENT.

	1900.	1901.
Interest on loans, &c.	,830	£9,873
Sinking fund for repayments	9,484	10,309
Net profit carried to depreciation account	2,731	4,418
Gross profit	£18,045	£24,600

Walsall Corporation Electricity Accounts.

THE position of the electricity supply department of the Walsall Corporation is very fair for an undertaking of the size, and the financial results year by year show an improvement that augurs well for the future. Thus at the end of 1899 there was a deficit of £395. The net profit made in 1900 reduced this to £275, and last year not only was this deficit balance extinguished, but a surplus balance of £106 remained for future use.

GENERAL STATEMENT.

	1900.	1901.	Inc.
Total capital expenditure ...	£34,310	**£43,339**	£9,029
Number of units sold	275,643	**340,232**	64,589
Maximum load in KW.	301	**347**	46
No. of public arc lamps	19	**19**	—
Gross revenue	£4,693	**£5,592**	£899
Gross expenditure...	£3,100	**£3,395**	£295
Gross profit	£1,593	**£2,197**	£604
Average price per unit sold ...	4·02d.	**3·88d.**	—·14d.

The revenue account calls for little comment. The gross receipts have increased by £899 owing to the sale of 64,589 additional units, but the average per unit has fallen by more than ¼d., so that the figure is now considerably less than 4d. per unit. As fees and other sundry charges are not made, the change appears unaltered in the total.

REVENUE STATEMENT.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Sale of energy	£4,610	4·02d.	**£5,492**	3·88d.	—·14d.
Meter rents	83	·07d.	**100**	·07d.	·00d.
Sale of lamps, &c.	—	—	—	—	—
Sundry fees, &c.	—	—	—	—	—
Gross revenue ...	£4,693	4·09d.	**£5,592**	3·95d.	—·14d.

The very moderate coal bill has been further reduced by the substantial figure of over $\frac{1}{10}$d. per unit, and is now only ⅛d. The additional output has been generated with an addition of only £100 to the gross coal bill. "Repairs" have been reduced not only per unit but in the total annual expenditure, and these economies, coupled with smaller wages and salaries, have brought the total cost down by nearly ⅓d. to 2⅔d., notwithstanding trivial rises in rates and establishment charges.

COST OF PRODUCTION.

	1900. Gross.	1900. Per unit.	1901. Gross.	1901. Per unit.	Inc.
Coal	£1,041	·91d.	**£1,140**	**·80d.**	—·11d.
Oil, waste, water, and engine room stores.	159	·14d.	203	**·14d.**	·00d.
Salaries and wages incurred in generation and distribution, attending street lamps	551	·48d.	603	**·43d.**	—·05d.
Repairs and maintenance of buildings, engines, boilers, dynamos, &c.	770	·67d.	730	**·52d.**	—·15d.
Works costs	£2,521	2·20d.	£2,676	**1·89d.**	—·31d.
Rent, rates and taxes ..	246	·21d.	336	**·24d.**	+·03d.
Management expenses, salaries of managing engineer, secretary, clerks, &c.	240	·21d.	259	**·18d.**	—·03d.
General establishment charges, stationery and printing, law charges and insurance	93	·08d.	124	**·09d.**	+·01d.
Other expenses	—	—	—	—	—
Total costs ...	£3,100	2·70d.	£3,395	**2·40d.**	—·30d.

The gross profit having increased by £604, and financial charges only requiring an extra £342, there was £262 left as additional net profit. The total, therefore, of the surplus monies has risen from £120 to £382, and we have already indicated the effect this has had on the balance-sheet.

PROFIT STATEMENT.

	1900.	1901.
Interest on loans	£757	£1,070
Sinking fund for repayments	716	745
Net profit carried forward	120	382
Gross profit	£1,593	£2,197

CITY NOTES.

The West India and Panama Telegraph Company.

THE fiftieth ordinary general meeting of the shareholders of this company was held on Wednesday at Winchester House, Old Broad Street, Mr. W. B. Kingsford presiding, in the absence, through indisposition, of the chairman, Mr. W. S. Andrews.

In proposing the adoption of the report, after expressing regret at the absence of Mr. Andrews, the CHAIRMAN said the duty which devolved upon him in addressing the shareholders had been rendered a very sad and painful one through the tragic and calamitous events which were within the knowledge of them all. The appalling catastrophe which had shattered the lovely island of Martinique, cast over their meeting its black and baleful shadow. Their good friends and neighbours across the Channel might be well assured that they had the profound and heartfelt sympathy of the whole English people. Their hearts were also filled with sincerest sympathy for our common fellow countrymen and fellow subjects in the stricken island of St. Vincent. Their company found a conspicuous place in the melancholy story of sorrow and disaster. On the fatal morning of the 8th inst., while she was in the roadstead of St. Pierre engaged in repairing one of their broken cables, their ship, the *Grappler*, with the captain and all hands was utterly destroyed. Standing as she was close by the foot of the mountain, it appeared that she was the very first of the many ill-fated vessels which perished when the fiery deluge fell upon the doomed city and overwhelmed the shipping in the harbour. At the moment of the great explosion the crew of a schooner, which was making for Dominica, actually saw their vessel wrapped in a sheet of flame and consumed. She had on board, including the captain, 11 Englishmen and 45 West India men—56 souls all told—her full complement. Captain Boreham entered their service in 1891, and was a good and efficient officer. Mr. Marshall, the chief engineer, had also been with them for about 12 years. He manifested a keen professional interest in his work, which he always performed right well. Mr. Murphy, their chief electrician, joined them so recently as April last; and that was, in fact, his first expedition. They received with him the highest certificates of character and fitness, and they felt themselves very fortunate in securing the services of a man so truly trustworthy and able. Their ship's company throughout was a good one. In the destruction of the city they had lost in Mr. Miller, their clerk-in-charge, a much valued official. More than 20 years ago he came to them, and he had steadily worked his way up to that most important post, the duties of which he had always performed most admirably. In those most sad and distressing circumstances he was sure it would be their wish that, on behalf of the board and of all the shareholders, there should be conveyed to the relatives and friends of the poor fellows who had perished in that most tragic and terrible disaster an expression of deep sympathy with them in their sorrow and bereavement. Turning to the report, they would note that the receipts for the present half-year amounted to £25,243 compared with £24,300 for the corresponding period of last year—an increase of £943. The traffics for the half-year amounted to £1,140 more, and that and some smaller items made a total increase of £1,588. As a set off to that, the subsidies were £638 less, owing mainly, if not entirely, to deductions for interruptions in their cables, thus making the net increase £943. The expenses amounted to £19,836, as compared with £20,962, a decrease of £1,126, due to the smaller cost of repairs. The final result showed a profit balance of £5,407, to which had to be added the balance on last year's account, £6,512, and the interest on investments, amounting to £2,529. There was thus available £14,448, out of which the directors recommended the payment of a dividend on the first preference arrears account of 6s, which would take £10,369, carrying forward a balance of £4,079. Since the date of their last meeting the Brussels Sugar Conference had agreed, subject

to ratification by the chief European powers, to abolish, as from September 1st, 1903, all bounties upon the production of export sugar. Unluckily, the position remained very far from satisfactory, the present price of sugar being, as he understood, from £2 to £3 below the actual cost of production. Their appeal to the House of Lords in the Cuba Company's action might perhaps come on for hearing in the course of a few weeks, but the law's delays were proverbial. The Submarine Cables Committee had issued their report, and it was gratifying to the board to find that they ascribed the position of the company to the paucity of traffic in the region served by their cables, which, of course, was a thing absolutely beyond their control. He regretted that the Committee did not make any such recommendation as they had hoped, but it appeared to them that under the present circumstances, which had greatly changed their position, some such help might even yet be given.

Mr. Henry Holmes, in seconding the motion, referred in feeling terms to the sad loss of life which the company had suffered in St. Pierre, and said that as most of those lost were breadwinners, he thought they would wish to show their sympathy in a practical way by giving help to those left in need. The company was a poor one, and he did not know whether they could do anything, but he would be glad to start a fund by giving £5.

Mr. Thorpe and other shareholders expressed the opinion that the company should certainly do something in the way of helping the relatives and dependants of their servants who had perished in the disaster, and, after some discussion, a unanimous resolution was passed authorising the directors to spend such a sum of money with that object as they might think desirable.

Replying to questions, the Chairman said that four of their cables were broken, but as yet they could not say whether they had been destroyed.

The report was then adopted, and the retiring director, Mr. Andrew, re-elected.

Eastern Extension, Australasia and China Telegraph Company.

Sir J. Wolfe Barry, chairman, presided at the fifty-seventh half-yearly general meeting of the shareholders of this company, held on Wednesday, May 7th, at River Plate House, Finsbury Circus, E.C. In proposing the adoption of the report, he said the gross revenue for the half-year ending December, 1901, amounted to £324,000, against £360,000 in the corresponding period of the previous year, a decrease of £36,000. Of this sum nearly £20,000 was due to traffic with Australasia and the remainder to traffic with China, Japan and the Philippines. It must, however, be borne in mind that the traffic of 1900 had been abnormally large, consequent upon the troublesome times in China and elsewhere. This, therefore, had naturally made the traffic receipts for last year compare somewhat unfavourably, but as a matter of fact, it was not unsatisfactory so far as China and Japan were concerned. The Australasian traffic had been very disappointing, for the number of words transmitted had remained almost stationary, in spite of the very large reductions in the rates. That unsatisfactory condition of things might possibly be due to the uncertainty which had prevailed in Australasian circles with regard to the new Tariff Bill, which Bill, he was glad to report, was now settled, and possibly they would see the effects of it in increased traffic. The working and other expenses during the half year had unfortunately shown an increase of £15,600, of which £6,000 was due to increased cost of maintenance of cables, due to circumstances over which they had no control, and the balance was accounted for by the opening of new stations in connection with the Cape—Australasia cable. Taking the figures for the whole of 1901, it was found that the decrease in the gross revenue receipts was not so great, the total decrease for the whole year being £3,500. The expenses, of course, still remained heavy, they being for the year £22,000, but were mainly due to causes not connected with the traffic. The usual quarterly dividends of 2s. 6d. per share had been paid, and a final dividend was now recommended, making 5 per cent. for the year, and in addition a bonus of 4s. per share, or 2 per cent., making a total distribution of 7 per cent., which, he hoped, under all the circumstances, would not be considered unsatisfactory. After crediting the subsidiary reserve funds with the usual contribution, there was a revenue balance of £69,560, which had been carried to the general reserve fund, making, with the £125,000 already contributed, a total amount from revenue of £194,560 for the year. On the other hand, they had to debit the general reserve fund during the year with £497,000 for expenditure on account of the Cape—Australasia cable, and in carrying out partial renewals of their systems. The general reserve fund now stood at £969,800. Since the close of the half-year the last section of their great enterprise connecting the Cape and Australia had been successfully laid, and the whole line had been opened for traffic. The line was 7,600 nautical miles in length, and it passed in places at a depth of 3,400 fathoms of water, or about 700 fathoms deeper than the waters in which the Atlantic cables were submerged. Everything had been carried out in record time and without a hitch, and the board thought great credit was due to the contractors, the Telegraph Construction Company, for the excellent manner in which that very important work had been carried out. The tariff for telegrams exchanged with the contracting States—South Australia, Western Australia, Tasmania, and New South Wales—was further reduced on January 1st from 3s. 6d. to 3s. a word for ordinary messages with proportionate reductions for Government and Press telegrams. If the standard revenue was maintained during the current year, the tariff would be further reduced next January to 2s. 6d., but in order to realise this reduction he was bound to say that the Australasian traffic would have to show much more vitality than in the past few years. They had also been in a position to make substantial reductions in the tariffs from telegrams exchanged between the Straits Settlements and Netherlands, India. The rates had been reduced from 5s. 3d. to 4s. 5d. The first section of the Pacific cable between Australia and New Zealand, belonging to the British and Colonial Government, was opened for traffic last month, when competition was started with the company's cables between Australia and New Zealand. He was sorry to say that the Federal Government had announced a reduced uniform terminal rate for the Pacific route, while maintaining the higher differential terminal rates for the company's traffic between New Zealand and Australia. This was a proceeding opposed to the terms of the special contract made between the company and the New Zealand and New South Wales Governments when the cable was laid, and was also contrary in the board's view to the International Telegraph Convention. Negotiations were in progress on the subject, and they had every hope that when the injustice of the differential rates was pointed out to the Federal Government, the latter would retreat from what he believed was an untenable position, certainly untenable in view of the special agreement between the company and the New South Wales Government, and he could not help thinking untenable in view of those principles of free trade which they had been told would be applied to the competition between a Government cable subsidised by public money and a cable supported by private resources, which had done so much good for Australasia in times past. The negotiations between the company and the Federal Government for substituting a uniform agreement for the whole Commonwealth in place of the agreements with the four contracting States had not yet had any practical result, but they had been informed that when Mr. Barton, the Prime Minister, was in London next month, he would further discuss the matter with them. Meanwhile the higher rates were maintained in Victoria and Queensland, and the merchants there were agitating for their assimilation to the rates charged to the rest of the Commonwealth. The board very earnestly desired to bring that assimilation about, but at the same time they felt that they had a right to ask that in the two States which still held out the company should have the same right of dealing directly with the public that had been given to them under the arrangements with the other four contracting States which enjoyed the lower tariff. The chairman then proceeded to refer to the report issued by the Inter-Departmental Committee, which was appointed by the Government to inquire into the question of tariffs and matters connected with cable communication. He said the Committee had from its constitution commanded universal respect, and had left no matters uninvestigated that were placed before them. Having considered the different proposals which had been laid before them, the Committee only recommended three extensions, two of which affected that company, one of them only to a slight extent, which was a proposed landline between Burma and the Straits Settlements, a proposal the board did not view with any dissatisfaction. The other recommendation, however, was a more important one. It was suggested that for strategic purposes there should be a linking up of their cable with the Island of Cocus to Ceylon for the purpose of giving an alternate route to India. The board had not taken any steps with regard to the report generally, but they would be happy to consider with the Government how such a cable should be laid provided that the interests of the company's shareholders were safeguarded. Regarding the concluding paragraph in the report about tariffs, the committee, after having heard the alternatives which had been put forward by such gentlemen as Mr. Henniker Heaton and Sir Edward Sassoon, had said that they were not prepared to say that any of the rates were excessive with one exception—viz., that of the Gold Coast to Nigeria, which it was considered should be further reduced. He had no doubt the directors would be able to show the Government very good reasons for the change which had been made, as, although the traffic in question was very small, it was conducted at great cost. He ought perhaps before concluding to make just a few remarks as to the subject of wireless telegraphy. In addressing the meeting last year he had taken the opportunity to say a few words on the subject, which had been very widely circulated, and he would only add now that there had since been no new development of a practical nature. He had nothing to withdraw from what he had said at the last meeting, and his views, he thought, had lately been endorsed by Lord Kelvin in America, that wireless telegraphy might be a useful adjunct to telegraphy, but it would not benefit the legitimate work of submarine cables.

Sir J. Denison Pender seconded the motion, and the report was adopted.

New General Traction Company.

The sixth annual general meeting of the above company was held at Salisbury House, E.C., on Monday morning under the chairmanship of Baron Emile B. D'Erlanger.

In moving the adoption of the report, the Chairman referred first to the death of Capt. Pavey, the old chairman of the company. The accounts showed some noteworthy changes from last year. Taking the balance-sheet, they found the share capital unaltered at £370,000. Then came the item of £181,300 debentures, which appeared in the accounts for the first time. About a year ago they issued £200,000 debentures, of which £181,300 was actually subscribed. Most of the subscriptions, however, came from the directors and their friends. Those debentures served to wipe out the item of £157,000 which was the floating debt in the last year's balance-sheet. They had an unappropriated balance on March 23rd, 1901, of £41,135, and a profit for this year of £40,526, making a total of

£81,661. With that amount and the reserve they intended to wipe out the goodwill entirely. Coming to the credit side of the balance-sheet, they had a little more cash in hand. Last year it was £1,501, and this year £2,000. On the other hand, they had this year £561,698 in securities of different companies, whilst last year they had only £482,073, which showed an increase in their holding in subsidiary companies of £79,625. Their Parliamentary deposits only amounted to a little more than £3,000, as against £22,367, which meant that they had completed a good deal of the work they had under construction, and therefore the Parliamentary deposits had been returned. The goodwill at cost stood at £120,000, but deducting the two reserves of £30,000 and £20,000, and transferring the £70,000 from the profits, the goodwill was entirely wiped out. Coming to the profit and loss account, there was a small increase in the expenses of £340. On the other hand, the interest on loans now repaying showed a diminution of £1,480, and the expenses connected with tramway concessions not obtained showed a diminution of £1,380. Passing to the other side they would find that dividends and interest received on shares amounted to £12,790, and the profit on construction of tramways was £47,659, making a total of £60,449. Last year, while their profit amounted to £53,209, it only included £2,765 for interest on dividends, but this year this item realised £12,790, and he felt perfectly certain that next year they would see that figure considerably enhanced, and in another year or two more than doubled. As to why they had passed over the dividend this year there were three reasons. In the first place, he had always considered that the item of goodwill in the balance-sheet was an eyesore, and that as soon as possible they should wipe it out, and the shareholders had shown their idea of the value of that goodwill by selling their preference shares below cost. Secondly, in order to pay a dividend, as their assets were not liquid, and consisted of shares, they would have had to have borrowed that money, and they all considered that to borrow money for the purpose of paying a dividend was not sound policy. The third and most important reason for passing the dividend was, that the auditors and the board had valued all their shares at par, and they could not value them at any other figure. At the same time they did not consider it was right, for the purpose of paying a dividend, to value the shares at par unless they could sell them at par, or were earning such dividends as to put it beyond all doubt that they were worth par. They held 12,262 preference shares out of £25,573 preference shares in the Douglas Tramways and 9,668 ordinary shares out of 15,472. That was a purely holiday tramway, and last year the preference shares paid the full 7 per cent. and the ordinary shares 2½ per cent. There was a good future before that undertaking. In the Coventry tramways the company owned 10,267 £10 shares. These tramways had suffered from the great trade depression owing to the collapse of the cycle boom in that town, but last year the dividend was 2½ per cent., and he thought it not improbable that this year the dividend would be 4 per cent., and gradually, he believed, the dividends would grow. The only drawback was that within the next two years about £20,000 would have to be expended in relaying the old lines. In the Norwich tramways they held £1,200 debentures and 19,220 shares, and he believed those tramways would show good dividends. With regard to the Philadelphia tramways, they had had a great fight with their competitors, but they had won up to the Supreme Courts. To complete these tramways they would want about £300,000, and then they would have a complete system of 23 miles, and in that venture they held $805,000 of debentures and about $680,000 of ordinary stock, or in round figures about £290,000. With this complete, they would hold 58 miles of constructed tramways, or £620,000 shares and various other assets, amongst which was the order for a tramway in the North, which was not opposed at present. They thus had securities amounting to £620,000 and other assets worth about £10,000. He did not think that a situation which called for much criticism, for during the time they had been accumulating those assets they had paid about £70,000 in dividends.

Mr. Brand, M.P., seconded the motion.

Lord Ebury severely criticised the past financial operations of the company, and said it was an affront to the common sense of shareholders to put forth such a document as that which they had before them that day. The cardinal point of the whole matter was that the directors claimed to have an accumulated profit of £81,000 but were unable to pay the preference dividend, which would have taken but £15,000. It appeared to him with regard to the debenture issue, that they had hypothecated anything which was of value, and such a mortgage would be the ruin of the preference shares. The wiping out of the goodwill in the wholesale way it had been done in priority to the preference dividend, was entirely unprecedented in the whole of his experience. He moved an amendment, "That this meeting be adjourned until Monday, the 26th inst., at the same hour, in order that meanwhile the directors may furnish the shareholders with such printed information as will enable them to form an opinion of the company's financial position."

Mr. G. Hitching seconded the amendment, and said that last year he criticised the company's finance, and now they heard that the dividend was paid in full on the preference shares, and 4 per cent. on the ordinary shares, although only £2,000 odd was received from interest on shares. The rest of their assets were paper assets. He pointed out that when they were only earning 2½ to 4 per cent. on their securities, they could not pay dividends of 6 or 7 per cent. He did not agree with all the financial methods of the British Electric Traction Company, but at all events they did publish the accounts of the subsidiary companies with their own report.

The Chairman denied that the indictment of Lord Ebury was a true one, and said he had no reason to feel depressed at the way the company had been managed. To meet that point, however, he was prepared to undertake to send to the shareholders a list of the securities they held, and next year to give the balance sheets of the subsidiary companies in the report.

After further discussion, Lord Ebury withdrew his amendment on this understanding, and the report was adopted.

Further discussion arose on a question of Lord Ebury with regard to the underwriting of the debenture issue, which the Chairman said had been to a great extent undertaken by the directors, and Lord Ebury contended that whatever was paid to the directors, the company was entitled to have returned.

This discussion came to nothing, and the meeting concluded with the re-election of the retiring directors and auditors.

Elmore's German and Austro-Hungarian Metal Company.

Mr. J. MacFarlen presided on Wednesday last week over the eleventh annual meeting of the above company, held at Winchester House, E.C., and in moving the adoption of the report, said he regretted that he had to meet them under unpleasant circumstances, but the directors had the consolation of knowing that the loss made on the last year's trading was due entirely to circumstances beyond their control. The work done at the factory, even as far as November, showed a considerable profit, and although Germany was passing through an industrial and financial crisis, the amount of work received from customers not only showed no diminution, but actually a considerable increase. This spoke highly of the products of the company. On this side, too, they suffered during the year, for at one period they felt confident of carrying through the conversion of the debenture stock, which meant so much to them, apart from the saving in interest. It was absurd that occupying the important position they did amongst the manufacturers of Germany, they should pay 8 per cent. for their debenture stock, and were it not for the fact that so many of their debenture stockholders were shareholders, he thought they should make any sacrifice to reduce the rate of interest if only for their credit's sake. Under the present circumstances it meant that the shareholders got less by way of dividends, they had none by way of interest, and at the same time they got a fixed sum and got it regularly. They found, after considerable negotiation, that they could not profitably underwrite the new issue of stock, and therefore the directors considered there was no alternative but to ask for an extension of time for the redemption of the stock. After a considerable amount of thought and consideration, it was decided to ask the stockholders to postpone the redemption for three years, which would bring them to the period when the preference shareholders would cease to take $\frac{9}{10}$ths of the profits, and when the whole question of a re-arrangement of the company's finances could be taken up, without in any way interfering with the rights of one or other of the shareholders, and he thought they would admit that such a proposal was the right one for them to adopt. Unfortunately, however, a holder of £100 of debenture stock—a Mr. Walker—thought otherwise, and while he had no alternative but to agree to the postponement, he did not agree to the increase of the stock from £75,000 to £100,000. Mr. Walker entered into litigation, and so far the company had had the benefit of the opinion of four of the most eminent judges in the land, and that opinion was entirely in their favour. Mr. Walker, however, was not satisfied to accept their decision, and he was going on with his action, and they had done their best to bring the matter to an early conclusion. To bring matters up to date, he was glad to inform them that matters were proceeding well with them, for they were showing an increase in their sales as compared with the same period of last year, and had at the present moment a list of orders which was remarkable for its size, being larger by far than anything they had ever had before, and that, perhaps, was more conclusive than anything as to the quality of the goods they produced. He was glad to say they had again secured the Government contract for a further three years. The last contract was for three years, but under that contract the Government had the right to continue for a further 12 months. They exercised that right, and at the expiration of the fourth year they asked them again would they continue? They did so, and that contract, which was originally for three years, ran into five years, and they had a contract before with them for certain sizes of tubes for three years, therefore the Government had had an opportunity of testing, and testing largely, the value of their products, and he claimed that it would be impossible for them to obtain a better testimonial. He could tell them of many other instances which showed how highly the goods of their company were esteemed by those who used them, but it was not advisable from a trading point of view, and he would say no more than he had said.

Mr. Heal seconded the motion.

Replying to questions, Mr. H. Ellis (managing director) said the turnover in money was practically the same in the past year as the previous year—about £100,000 sterling—but there was an increase in the weight, as copper dropped during the year. The Government contract was profitable, and it gave a standing to the company. Last year the German Government had no money owing to the China expedition, and gave out no work, but now they were sending out orders wholesale.

The report was adopted.

English Electro-Metallurgical Company.

The Marquis d'Hautpoul presided at the meeting held on May 9th at Salisbury House, E.C. He moved the adoption of the following report:—

The directors present accounts and balance-sheet to December 31st last. The works at Leeds have now been completed and handed over for the current working by the company's own staff. The actual test working of the machinery began in November last, and a few difficulties inseparable from the starting of new works led to some slight delays. These, however, were speedily overcome, and the manufacture has been proceeding smoothly ever since, and since January upon a commercial scale. The certificate of the Admiralty has been obtained, placing the company upon their list for all general purposes. The tests of the Board of Trade are now proceeding, and it is expected that their certificate, which takes a longer time to obtain, will be given about June. All tests made show the tubes produced to be of most superior quality. In September last the directors secured the services of Mr. H. J. Elliott, late general manager of Elliott's Metal Company, as general manager of the company, and in December appointed Mr. Parkes, formerly of Bolton's Copper Works, as works manager. They have every reason to be satisfied, therefore, that the executive management will be in safe and experienced hands. Both the gentlemen named, accustomed as they have been to the ordinary methods of tube making, are more than surprised at the advantages offered by the company's process as now put in practice. The acknowledgments of the company are due to Messrs. Demmler & Bethmont, under whose supervision the reconstruction of the works has been carried out. Considerable complications have arisen in the execution of the purchase contract by differing interpretations thereof put upon it by Elmore's Trust and ourselves. In order, therefore, to get an authoritative decision on these points, the company commenced an action (it may almost be termed a friendly action) against Elmore's Trust in July last, and this was complicated by one of the bondholders of the Glasdir Copper Mines suing the Trust under the guarantee given upon these debentures by the late Elmore Copper Companies. The progress of these matters before the Court was, however, so slow, that, by mutual arrangement, they have been referred by the Judge to Mr. Cohen, K.C., as special referee. The preparation of the accounts has been somewhat delayed in the hope that Mr. Cohen's decision should be received and given effect to. In this the directors have been disappointed, but it is possible that something may be known by the date of the meeting of shareholders. It has been found that the present name of the company is rather an awkward one for common use, being more after French than English models; it is, therefore, proposed to alter it by a special resolution which will be submitted at the meeting of shareholders. The name proposed to be adopted is "The Leeds Copper Works, Limited."

As announced in the last report, the directors have had to defend an action brought by the Metallurgical Engineering Company in respect of the Elmore Rapid Process. The matter proved to be complicated with many other things of the past history of the old companies, and owing to the terms of the contracts entered into by them, it was impracticable to maintain the option over the Rapid Process without considerable disbursements, which, in the present state of our knowledge, would be purely speculative. On the other hand, there was a grave question whether the company had not incurred a certain amount of responsibility for the safe custody of the experimental plant supplied in connection with the process by the Metallurgical Engineering Syndicate, and if the action had been lost on these minor points we should have had to pay a certain proportion of costs also; so that when by the good offices of a mutual friend a compromise was proposed costing us only £750, the directors decided to accept it rather than continue the litigation. The board the more willingly agreed to the suggestion conveyed to them because it implied a restoration of friendly relations with the Messrs. Elmore, with whom, as directors of the Metallurgical Engineering Company, the position has been somewhat acutely strained. As a result of these better relations, it is hoped that an arrangement will be come to with the Glasdir Copper Mines, chiefly represented by the Messrs. Elmore, by which this company's interests will be safeguarded, and the mine, which has been in the hands of a receiver for some months, will be set on a paying basis.

In the course of his speech the CHAIRMAN said that any award that Mr. Cohen, K.C., might give involving further payment by this company would have to be treated in the balance-sheet as part of the purchase price. The directors believed that such items as might be given against them would be only of trifling amount, but the matters at issue involved more than £12,000 of claims by the vendors, which the directors repudiated. The sum which they had paid in compromise of the action with the Metallurgical Engineering Syndicate had been placed to the same account, as their liability there was a consequence of former engagements entered into. After referring to the accounts, the speaker said that the company had been upon a commercial scale and basis since the month of January, gradually increasing the output and extending the connections. The new works were better arranged, they worked much more economically, and produced a copper as good as the original Dives works. At the present moment their output was on the basis of 25 tons gross per week, but they were equal to a turnover of 60 tons. The Inspector of the Admiralty had tested and approved of their tubes, and for all general purposes they were placed upon the official list. For steam pipes, both on the Admiralty list and for the Mercantile Marine, they had still to await the Board of Trade tests, which began a fortnight ago, and ought to be concluded before the end of this month. They hoped then to obtain an almost immediate augmentation of business, although in many cases they must be shut out until the end of the year, when yearly tenders came to be fixed. After referring in some detail to the changes in the management, the Chairman said that the copper market had got upon a more normal basis, and this was of great importance. The lower the price of the raw material the more demand there would be for the company's wares, and the risk of carrying stock would also be very much reduced. As matters now stood there was more expectation of a rise in value than a further fall, but in any case the fluctuations cannot be of so serious moment as those of last year. Under the advice of their managers, they had decided to add a small plant for making brass tubes. The plant will be capable of turning out about 80 tons a month, and will greatly facilitate taking orders from firms who require supplies both of copper and brass goods.

Mr. A. DEMMLER seconded the motion, and it was adopted.

Cuba Submarine Telegraph Company.

THE sixty-first half-yearly meeting of the shareholders of this company was held on Wednesday last week at the offices of the company, 58, Old Broad Street, E.C., Mr. Charles W. Parish (chairman) presiding.

The CHAIRMAN, in proposing the adoption of the report, said that, with regard to the traffic of the company for the past half-year, he would like to call their attention to the comparative statements for the years 1900 and 1901. The receipts from the traffic for the year 1900 amounted to £22,081, and in 1901 they gave a total of £19,251. That reduction was due to the local rates having been lower in May, 1900, and which had made comparison in the accounts useless during the first six months of 1900 and 1901. In reviewing the last six months of 1901 with those of 1900, they had been working under practically the same conditions, and he was glad to point out that from July to December of 1901, the amount of traffic receipts was £9,270, as against £8,903 for the same period of 1900, being an increase of £367, which, although not a very important amount, was a satisfactory sign. Adding to the £9,270 received in traffic receipts for the last half of 1901 the £2,093 received as interest on investments, &c., they had a total of £11,363 to deal with. While their expenses for the past half year had been £5,334, those in the second half of 1900 were £5,502, or an increase of £168, which was, he thought, a very small variation on such a large business, and really confirmed the opinion expressed by him before, that they had no elasticity in the accounts to cut down or economise upon. Both in Cuba and in London the officials of the company thoroughly understood that they had to work as economically as possible, which he was sure they did in every respect. As regarded the dividends, the preference shares absorbed £3,000, and they proposed to pay 4 per cent. on the ordinary shares, which would need £2,300, and would carry forward £4,590 to the next half year's accounts as compared with £4,761 brought forward from June, 1901. It was satisfactory to learn that the broken cable which the company had between Cape-Cruz—Santiago section of the Manzanillo—Santiago cable had been successfully repaired. They had hired a steamer, the *Newington*, for the purpose, which went out under the superintendence of Mr. Keith. The cable was found to be broken in very deep water, and considerable skill was required to repair the damage. He was glad to say that Mr. Keith was able to telegraph to them on March last that the cable was in good working order. The cost of the hiring of the steamer and the cable used would not fall far short of £6,000 or £7,000, which amount they would meet out of the reserve fund. Of course, they were aware that the reserve fund was accumulated for that very purpose, and they had, therefore, to be thankful that they had that fund to call upon in those emergencies. He regretted to state that the company had been unable to report the settlement of the claim for the damage done to their cables during the South American war, but it was understood that the Bill respecting the same was now pending in the House of Representatives, and the Foreign Office had been helping them as much as possible in the matter. He would read to them the last communication they had received from the Foreign Office on the matter, which was dated April 10th, 1902. It was addressed to the secretary as follows:—"Dear Sir,—With reference to my letter of the 12th ult. relative to the claims of your company against the United States Government, I am directed by the Marquis of Lansdowne to inform you that his Lordship has now received a dispatch from the Ambassador at Washington, stating that the note which his Excellency addressed to the United States Government on December 26th, 1900, on the subject, is still unanswered. Mr. Hay has, however, promised to press for action on the Bill now pending in the House of Representatives for granting reimbursements for the expense incurred by your company in repairing their cables. As regards the question of arrears of subsidy, Lord Pauncefote is of opinion that it would be useless to take further action in the matter until the change of Government in Cuba has been effected, the date of which has now been fixed for May 20th.—I am, Sir, your humble servant, F. H. Villiers." It was, he thought, rather annoying that this unsettled claim went as far back as 1898, but they must remember that the United States Government had had a considerable task to deal with in Cuba, and they could only hope their claim would be settled now as quickly as possible, for it was believed that during this month the new Government came into operation in Cuba. As regarded the lawsuit between the West India Panama Company and themselves, he believed the Bill of the company in the House of Lords would come up for discussion next autumn.

Mr. R. K. GRAY seconded the motion.

Replying to a shareholder, the CHAIRMAN said he thought the Marconi system was in such an early stage that it would not affect the company to a very large degree.

The report was adopted.

Telegraph Manufacturing Company.

AN extraordinary general meeting of the above company was held last Friday at Liverpool to consider the proposal to amalgamate with the British Insulated Wire Co., Ltd. Mr. James Taylor (chairman of the company) presided.

The solicitor read the agreement, dated April 28th, 1902, between the Telegraph Manufacturing Co. (the vendor) and the British Insulated Wire Co. (the purchaser). The vendor company agrees to sell, and the purchaser company to purchase the whole of the assets and undertaking of the vendor, except the sum of £12,354, which the vendor company retains. The purchaser is to pay to the vendor company the sum of £400,000, to be satisfied by the allotment to the vendor company or its nominees of 20,000 fully paid-up preference shares of £5 each, and 30,000 fully paid-up ordinary shares of £5 each in the purchasing company. The sale takes effect as from December 31st last, and is to be completed on May 31st. The name of the purchaser company is to be changed into one embodying the distinctive features of the name of the two companies.

The CHAIRMAN, in moving that the agreement be confirmed, said that it had been evident for some time to the directors that competition was increasing, and, therefore, the directors had come to

the conclusion it would be better to enter into partnership with a large firm doing this class of work rather than continue competitors, especially in view of the fact that two large companies in the south in a similar business were joining hands. The last four months showed a very substantial increase in the business of the British Insulated Wire Co., and with the prospect of better foreign trade the shares ought now to stand higher in the market.

The resolution was carried unanimously.—*Financial Times.*

South Wales Electrical Power Distribution Co.—Letters of allotment and regret for the issue of 45,000 shares have been posted.

TRAFFIC RECEIPTS.

Blackburn Corporation Tramways.—The receipts for the week ending May 9th were £705; corresponding week last year, £701: increase, £4. Total to date, £12,076; corresponding period last year, £10,661; increase, £1,415. Miles of track open, 10½.

Blackpool and Fleetwood Tramways.—The receipts for the week ending May 10th were £332; corresponding week last year, £335; decrease, £3. Total receipts to date, £4,578; corresponding period last year, £4,285; increase, £293.

Bristol Tramways and Carriage Company.—The receipts for the week ending May 9th were £4,103; corresponding period last year, £4,305; decrease, £202.

British Electric Traction Company.—The following returns are issued of the undertakings of this company for the week ending May 2nd:—

Company.	Amount	Comparison with corresponding week of last year.		No. of weeks.	Aggregate.		
					Amount.	Inc. or Dec.	
	£	+ £	− £		£	+ £	− £
Devonport*	383	—	—	17½	6,720	—	—
Dudley-Stourbridge	681	65	—	17½	11,417	2,068	—
Gateshead*	682	—	—	17½	11,164	—	—
Greenock-Pt. Glasgow	517	207	—	17½	7,085	3,951	—
Hartlepool	233	33	—	17½	3,491	270	—
Kidderminster ..	106	9	—	17½	1,726	150	—
Merthyr†	101	—	57	17½	3,332	—	423
Middleton*	281	—	—	17½	1,587	—	—
Oldham-Ashton ..	514	33	—	17½	8,229	33	—
Poole‡	245	—	1	17½	3,619	37	—
Potteries	1,476	110	—	17½	24,066	1,006	—
Southport	228	101	—	17½	2,860	805	—
South Staffordshire†	769	41	—	17½	14,753	696	—
Swansea	424	23	—	17½	7,198	672	—
Taunton*	56	—	—	17½	961	—	—
Tynemouth§	218	59	—	17½	3,480	203	—
Wolverhampton Dist.	159	109	—	17½	2,342	1,510	—

* Not in operation last year. † Partly steam. ‡ Comparison from April 5th only. § Comparison from March 18th only.

Central London Railway.—The receipts for the week ending May 10th were £7,088; corresponding week last year, £6,514; increase, £574. Total receipts to date, £126,884; corresponding period last year, £117,538; increase, £9,346. Miles open, 6.

City and South London Railway.—The receipts for the week ending May 11th were £3,050; corresponding week last year, £2,022; increase, £1,028. Total receipts to date (19 weeks), £56,507; corresponding period last year, £37,858; increase, £18,649. Miles open, 6¾; last year, 4¾.

Dover Corporation Tramways. — The receipts for the week ending May 10th were £182 4s. 4½d.; corresponding week last year, £197 6s. 8½d.; decrease, £15 2s. 4d. Total to date, £3,371 4s. 7d.; corresponding period last year, £3,286 0s. 0d.; increase, £103 4s. 7d. Miles of track open, 3. Car miles run, 1902, 5,130; 1901, 5,061. Number of cars, 1902, 11; 1901, 11.

Dublin United Tramways Company.—The receipts for the week ending May 9th were as follows:—D.U.T. Co., £3,669 2s. 10d.; D.S.D. Co. £807 18s. 6d.; total, £4,477 1s. 4d.; corresponding week last year—D.U.T. Co., £3,523 1s. 11d.; D.S.D. Co., £779 9s. 2d.; total, £4,302 11s. 1d.; increase, £174 10s. 3l.; aggregate to date, £76,899 10s. 11d.; last year, £73,263 2s. 9d.; increase, £3,636 8s. 2d. Mileage worked, 46.

East Ham Tramways.—The receipts for week ending May 10th, were £401 0s. 9d.; total to date, £16,607 2s. 9½d. Started running June 22nd, 1901. Car miles run, 10,940. Number of cars, 18; miles open, 5.

Glasgow Corporation Tramways.—For week ending May 3rd, £11,686 10s. 7d., compared with £11,756 8s. 1d. for same period in previous year. For week May 10th, £11,711 16s. 8d., compared with £10,691 7s. 9d. for same period in previous year. Aggregate since June 1st, 1901, £577,441, compared with £452,557 for corresponding period in previous year.

Liverpool Overhead Railway. — The receipts for the week ending May 11th were £1,419; corresponding week last year, £1,616; decrease, £197. Total to date £26,657; corresponding period last year, £29,167; decrease, £2,510. Miles open, 6 miles 57 chains.

STOCKS AND SHARES.

Wednesday Evening.

PROTRACTED watching for peace, and the proximity of the Whitsun holidays, are adverse factors to making of business in most of the Stock Exchange markets, but the electrical supply section acknowledges no lack of trade, and telegraph descriptions are fairly active. In the home railway market, too, there is considerably more interest taken in the electrical schemes, which press so thickly on all sides, than there is in steam stocks, and it is thought the time may not be far distant when a separate department will have to be formed for dealing in light railways alone. Of course, while the proposals are before the various Committees, there cannot be much financial activity; but as soon as what are left of them emerge from their trying ordeal, a lively time is anticipated.

The awful catastrophes in Martinique and St. Vincent have caused no change in that portion of the telegraph market devoted to West Indian specialities. West India and Panama Ordinary shares can hardly fall much lower than they already are, but the Preferences are immobile, the first Preference maintaining its advance of last week, while the Debentures are even up one point. The loss of the company's repairing ship *Grappler* is regarded as the most serious loss sustained by the West India and Panama Co., but the impression is that she was insured. Western Telegraphs are also unaltered, and the French company's issues command no market in Capel Court. The steadiness of this group has excited some surprise, which is all the more freely expressed from the general dulness of telegraph securities as a whole. Eastern Ordinary, for instance, has lost another three points, and is down to 120, at which price the return to an investor is only a shade under 6 per cent, taking the usual 7 per cent. dividend of the company as a basis of calculation. Eastern Extensions, however, are comparatively hard at 12½ *ex* dividend and bonus, so that the price is but little short of 10 per cent. above that of Eastern Ordinary. A trifling irregularity is shown in the senior securities of the Eastern division, but the changes are very insignificant. Indo-European, although *ex* dividend, show no change.

Anglo-American Preferred has slid back a little, losing its gain of last week, but the other trans-Atlantic stocks call for no comment.

Further strength in City and South London stock is the feature amongst electrical railway descriptions. The Ordinary has advanced to 73, and already forecasts of the probable dividend are being circulated. Some tell us that 3½ per cent. will be paid, against the 1¾ distributed for the first half of 1901. The estimate seems distinctly overdrawn, and if the company declares 2½ to 3 per cent. there will be much satisfaction. Its 1891 Preference stock stands at 130, the 1896 at 125½, and that issued last year is quoted about 122, but the dealers do not bid more than 120. This last named stock is still largely held by those who took it up at 112 not so very long ago, and the market is somewhat timid in raising the price less it should be saddled with more than it wants. Otherwise with the excellent results being secured by the line, the 1901 Preference would look inviting at anywhere about its current quotation.

Great Northern and City Preferred Ordinary shares stick at 8½, despite the permission for the company to extend its line into Lothbury, the heart of the City. Metropolitan District stockholders are still perturbed at the prospect of the L.C.C. trams on the Embankment, but the stock is fairly firm at 32½, although Sir J. Wolfe Barry hinted that more money might be wanted for strengthening the tunnels if heavy cars are to run along the Embankment and over the District's subterranean lines. East London stock at 7¾ is indulging in its annual flutter, and London Tilbury stock is improving on the suggestions for electrification. Metropolitan keeps at about 81. Waterloo and City is unchanged at 92½. A hard and advancing market is London United Tramways new Debenture at 105, the provisional certificates being called 54, and investors are appreciating the good security which this stock offers. The Preference, however, are ¼ easier. British Electric Tractions are 14; in small lots some 2,000 shares have changed hands within the past fortnight, and an increase of 1 per cent. in the next dividend is not improbable. Westinghouse Debenture is 2 better at par, the Preference at 5⅞ and the Ordinary at 6¼ keep merely steady. Naturally there are rumours afloat as to Mr. J. P. Morgan "buying-up" the Westinghouse Company: the yarn was bound to come in connection with the reported negotiations over the Manchester Ship Canal and Trafford Park Estates.

New General Tractions are still miserably weak on the report issued the other day. That lamentable document was glossed over as favourably as might be at Monday's meeting, and further criticism upon the balance sheet would probably be supererogatory. The Ordinary shares are nominally £2 to £3 apiece, the 6 per cent. Preferences are 4, and the 5 per cent. Debentures are a couple of points below par. Calcutta Tramways are a little easier upon the issue of new shares, and Calcutta Electric Supply have sympathised to a small extent. Cape Electrics, however, are good at 2⅛, and Anglo-Argentines have strengthened to 4⅛.

Metropolitans remain an active feature in the Supply market, and have added another 10s. to their quotation. The eagerly-awaited award of the Marylebone arbitrators should be out within the next three or four weeks. Brush shares are steady to good, upon the passing round of a tip anent the recent fall having been overdone. Edmundson's are in request, and so are South London, although there is no change to report in the nominal price of either.

Orientals, in the Telephone market, are *ex* dividend, but keep at £1. Telegraph Manufacturing has receded 10s. upon deduction of the dividend, and the amalgamation has had no effect either upon these or British Insulated Wire shares.

SHARE LIST OF ELECTRICAL COMPANIES.—TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation May 7th.	Closing Quotations May 14th.	Business done during week ended May 14th, 1902. Highest.	Lowest.
82,300	African Direct Telegraph, 4 % Debs.	100	...	...	...	99 —103	99 —103	...	...
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	...	...	...	3½— 4½	3½— 4½	...	...
119,700£	Amazon Telegraph 5 % Debs., Nos. 1 to 1,250 Red.	100	...	...	...	70 — 80	70 — 80	...	...
804,720	Anglo-American Telegraph	Stock	73/6	3½%	61s.	44 — 47	44 — 47	44	...
3,097,640	Do. do. 6 % Pref.	Stock	6 %	6 %	6 %	89 — 91	88 — 90	89⅜	88⅛
3,097,640	Do. do. Deferred	Stock	£1 7s.	5s.	2s.	7 — 7½	7 — 7½	7 3/16	7 1/16
44,000	Chili Telephone, Nos. 1 to 44,000	5	4 %	5 %	...	3½— 4	3½— 4	3⅞	...
13,333,300$	Commercial Cable	$100	8 %	...	...	150 —160	150 —160	...	...
1,741,029£	Do. do. Sterling 500 year 4 % Deb. Stock Red.	Stock	...	...	...	93 — 96	93 — 96	94	...
16,000	Cuba Telegraph	10	7 %	...	...	4 — 5	4 — 5 xd	...	...
6,000	Do. 10 % Pref.	10	...	...	...	13 — 14	12½ — 13½xd	12½	...
12,931	Direct Spanish Telegraph	5	4 %	4 %	...	2½— 3½	2½— 3½	...	...
6,000	Do. do. 10 % Cum. Pref.	5	...	...	...	8½— 9½	8½— 9½	...	...
30,000£	Do. do. 4½ % Debs.	50	...	...	...	98 —102 %	99 —102	...	...
60,710£	Direct United States Cable	20	3½%	3¼%	...	9½— 10½	9½— 10½	...	...
101,300£	Direct West India Cable, 4½ % Reg. Deb., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —102	99 —102	...	...
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	...	120 —133	117 —127	122	117½
1,930,807	Do. 3½ % Pref. Stock	100	...	...	...	83 — 86	84 — 87	86¾	...
1,432,268£	Do. 4 % Mort. Deb. Stock Red.	Stock	...	...	...	107 —111	106 —110 xd	109	106½
300,000	Eastern Extension, Australasia, and China Telegraph	10	7 %	7 %	7 %	12½— 13½	12 — 13	13	12½
320,000£	Do. 4 % Deb. Stock	Stock	...	...	...	108 —113	107 —112	111	108½
300,000£	Eastern and South African Telegraph, 4 % Mort. Deb. Nos. 1 to 3,000, red. 1909	100	5¼ %	...	...	98 —101	99 —102	...	...
200,000£	Do. 4 % Reg. Mt. Debs. (Mauritius Sub.) 1—8,000	25	...	...	...	100 —103 %	99 —102	...	...
180,227	Globe Telegraph and Trust	10	5¼%	5¼%	...	8 — 9	8 — 9	8 1/16	8¼
180,042	Do. do. 6 % Pref.	10	...	...	...	12½— 13½	12½— 13½	12 1/16	12½
150,000	Great Northern Telegraph, of Copenhagen	10	...	15 %	...	26 — 28	26 — 28	27½	...
75,000	Halifax and Bermuda Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	...	...	...	99 —103	99 — 103	...	...
17,000	Indo-European Telegraph	25	10 %	10 %	10 %	37 — 41	37 — 41 xd	...	...
100,000£	London Platino-Brasilian Telegraph, 6 % Debs.	100	...	...	...	100 —104	100 —104	...	...
72,680	Montevideo Telephone, Limited, Ord., Nos. 1 to 72,680	1	2½%	...	...	½— ½	½— ½	...	...
86,492	Do. do. do. 5 % Pref., Nos. 1 to 86,492	1	5 %	...	...	⅞— 1	⅞— 1	...	...
983,333	National Telephone, Pref. Stock	100	5 %	5 %	5 %	95 — 99	95 — 99	97½	96
200,000	Do Pref. shares	2	...	3⅛	3⅜	3⅛— 3⅜	3⅛— 3⅜	...	...
1,966,667	Do Def. Stock	100	...	60	64 xd	56 — 60	55 — 59	55½	...
15,000	Do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	12½	...
15,000	Do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	12 — 14	12 — 14	...	...
250,000	Do. 5 % Non-cum. 3rd Pref., 1 to 250,000	5	5 %	5 %	5 %	4⅞— 5⅛	4⅞— 5⅛	...	...
2,000,000£	Do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	94 — 97	94 — 97	95½	94
500,000£	Do. 4 % Deb. Stock Red.	100	...	4 %	4 %	103 —107	103 —107	104¼	103½
171,504	Oriental Telephone and Elec., Nos. 1 to 171,504, fully paid	1	5 %	6 %	6 %	1 5/16— 1 1/16	1 5/16— 1 1/16xd	...	...
100,000£	Pacific and European Tel., 4 % Guar. Debs., 1 to 1,000	100	...	...	...	99 —102	99 —102	...	...
11,839	Reuter's	8	5 %	5 %	...	7 — 8	7 — 8	...	...
3,303	Submarine Cables Trust	Cert.	...	...	...	110 —120	119 —125	...	...
58,000	United River Plate Telephone	5	7 %	...	...	4⅜— 5¼	4½— 5	...	...
40,006	Do. do. 5 % Cum. pref. Nos. 1—40,000	5	...	...	...	4½— 5	4½— 5	...	...
179,947£	Do. do. 5 % Debs.	Stock	...	...	...	103 —106	103 —106	...	...
155,600	West African Telegraph, 5 % Debs.	100	...	...	...	99 —102	99 —102	...	...
30,008	West Coast of America, Nos. 1—30,000 and 53,001—53,008	2½	...	...	...	⅛— ⅜	⅛— ⅜	...	...
150,000£	Do. do. 4 % Debs., 1—1,500 gua. by Brss. Sub. Tel.	100	...	...	...	99 —102	99 —102	...	...
207,930	Western Telegraph, Ltd., Nos. 1—207,930	10	7 %	7 %	...	11½— 12½	11½ — 12½	12	11⅝
75,000£	Do. do. 5 % Debs. 2nd series, 1906	100	...	...	...	102 —105	102 —105	...	...
348,777£	Do. do. 4 % Deb. Stock Red.	100	...	...	...	99 —102	99 —102	...	...
88,321	West India and Panama Telegraph	10	⅝%	...	...	½— ⅝	½— ⅝	⅝	½
34,563	Do. do. do. 6 % Cum. 1st Pref.	10	...	...	...	5½ — 6	5½ — 6	...	...
4,669	Do. do. do. 6 % Cum. 2nd Pref.	10	...	...	...	3½ — 4½	3½ — 4½	...	...
80,000£	Do. do. do. 5 % Debs., Nos. 1 to 1,600	100	...	...	...	100 —103	101 — 104	...	...

ELECTRICITY SUPPLY COMPANIES.

100,000	Blackheath and Greenwich Dist. Electric Light, Ord.	1	...	...	...	½— ½	½— ½	...	...
100,000	Do. 4½ % 1st Deb. Stock, Prov. Certs.	100	...	...	...	100 —104	100 —104	...	...
19,661	Brompton & Kensington Elec. Lt. Sup., Ord., 101 to 19,761	5	6 %	6 %	8 %	9 — 9½	9 — 9½	...	...
20,000	Do. do. 7 % Cum. Pref.	5	...	...	...	9 — 9½	9 — 9½	...	...
50,000	Charing Cross and Strand Electricity Supply	5	9 %	9 %	10 %	9 — 10	9 — 10	...	...
50,000	Do. do. do. do. 4½% Cum. Pref.	5	...	...	...	5½— 5⅝	5½— 5⅝	5 9/16	5½
250,000	Do. do. do. 4% Deb. Stock Red.	100	...	...	...	105 —107	105 —107	...	...
34,000	*Chelsea Electricity Supply, Ord.	5	6 %	5¼%	4 %	5½— 5⅝	5 — 5½	...	...
150,000£	Do. do. do. % Deb. Stock Red.	Stock	...	...	...	110 —113	110 — 113	112½	112
70,579	City of London Electric Lighting, Ord. 40,001—110,579	10	4 %	0 %	5 %	8 — 9	8 — 9	...	...
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000£	Do. 5 % Deb. Stock, Scrip. (iss. at £115) all paid	...	...	...	...	123 —128	123 —128	...	...
200,000	Do. 4½% 2nd Deb. Stock, Prov. Certs., all paid	100	...	...	...	103 —106	103 —106	...	...
40,000	County of Lond. & Brush Prov. Elec. Ltg., Ord. 1—40,000	10	4 %	4 %	4 %	8 — 9	8 — 9	...	...
20,000	Do. do. do. 6 % Pref., 40,061—60,000	10	6 %	6 %	...	12 — 13	12 — 13	...	...
400,000£	Do. 4½ % Deb. Stock, Prov. Certs (all paid) Red.	...	...	...	..	107 —110	107 —110	...	...
35,500	Edmundson's Elec. Corp., Ord. Shares	5	6 %	7 %	...	6½— 6⅝	6½— 6⅝	6 7/16	...
20,000	Do. do. 6 % Cum. Pref.	...	...	...	...	6 — 6¼	6 — 6¼	...	...
120,000£	Do. do. 4½ % 1st Mort. Deb. Stock.	100	...	...	...	107 —110	107 —110	109	...
21,000	Kensington and Knightsbridge Electric, Ord.	5	11%	12%	10%	10 — 11	10 — 11	...	...
90,000	Do. do. do. 4 % Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
110,000	London Electric Supply Corporation, Limited, Ord.	3	...	...	...	1¼— 1⅜	1¼— 1⅜	...	...
49,840	Do. do. do. do. 6 % Pref.	5	...	...	...	4 — 4½	4 — 4½	...	...
250,000£	Do. do. do. 4% 1st Mt. Db. Stock Rd.	Stock	...	...	...	95 —100	95 - 100	...	...
98,769	Metropolitan Electric Supply, 101 to 62,500	10	5 %	6 %	6½%	15½— 16½	16 — 17	17	16
220,000£	Do. 4½% First Mortgage Debenture Stock	...	...	...	...	111 —115	111 —115	...	...
250,000£	Do. 3½% Mort. Deb. Stock Red.	Stock	...	...	...	97 —100	97 — 100	98½	...
8,652	Notting Hill Electric Lighting	10	7 %	7 %	6 %	14 — 15	14 — 15	...	...
40,000	St. James's and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	14½— 15½	14½— 15½	14⅞	...
20,000	Do. do. 7 % Pref., 20,081 to 40,080	5	7 %	7 %	7 %	8½— 9½	8½— 9½	...	...
150,000£	Do. do. 3½ % Deb. Stock Red.	100	...	...	...	98 —101	98 —101	...	...
12,000	Smithfield Market Elect. Supply, Ord.	5	...	...	...	1⅞ - 2¼	1⅞ - 2¼	...	...
50,000£	Do. do. 4 % Deb.	100	...	...	...	80 — 90	80 - 90	...	...
65,000	South London Electricity Supply, Ord.	5	...	...	...	2⅝— 3¼	3/4 - 3¼	3 1/16	...
109,518	Westminster Electric Supply, Ord.	5	13 %	10½%	10½%	11 — 12	11 — 12	11⅝	...

* Subject to Founders Shares.
† Quotations on Liverpool Stock Exchange.
‡ Unless otherwise stated all shares are fully paid.
§ Dividends paid in deferred share warrants, profits being used as capital.
Dividends marked ‖ are for a year consisting of the latter part of one year and the first part of the next.

SHARE LIST OF ELECTRICAL COMPANIES.—*Continued.*

ELECTRICAL RAILWAY, MANUFACTURING, AND INDUSTRIAL COMPANIES.

Present Issue.	NAME.	Stock or Share.	Dividends for the last three years. 1899.	1900.	1901.	Closing Quotation May 7th.	Closing Quotation May 14th.	Business done week ended May 14th, 1902. Highest	Lowest.
		‡							
20,000	British Aluminium 7 % Cum. Pref.	10	...	...	...	4½ — 5½	4½ — 5½	4¾	...
300,000£	Do. do. 5 % 1st Mort. Deb. Stock Red. ...	Stock	...	...	...	86 — 90 xd	86 — 90	...	...
62,074	British Electric Traction	10	8 %	9 %	...	13⅛ — 14⅛	13⅛ — 14⅛	14	13⅞
90,000	Do. do. 6 % Cum. Pref.	10	...	...	...	12¼ — 12⅝	12¼ — 12⅝	...	...
600,000£	Do. do. 5 % Perpetual Debenture Stock ...	Stock	...	...	...	124 —127	124 —127	126	...
70,000	British Insulated Wire Ord.	5	20 %	15 %	10 %	8 — 9 xd	8 — 9	...	...
70,000	Do. do. 6 % Cum. Pref.	5	...	...	...	5½ — 5⅝	5½ — 5⅝	...	...
50,000	¶Browett, Lindley & Co. (1899), Ord.	£1	...	8 %	...	13s. to 15s.	13s. to 15s.	...	...
50,000	¶ „ „ „ 6 % Cum. Pref.	£1	...	6 %	...	16/6 to 17/0	16/6 to 17/0	...	...
105,731	Brush Elecl. Enging., Ord., 1 to 105,731	2	5½%	5 %	Nil	½ — 1	¾ — 1¼	..	...
150,000	Do. do. Non-cum. 6 % Pref.	2	6 %	6 %	3 %	1½ — 1⅝	1½ — 2	1 1/16	...
125,000£	Do. do. 4½ % Perp. Deb. Stock	Stock	...	...	...	101 —104	101 —104	...	...
125,000£	Do. do. 4½ % Perp. 2nd Deb. Stock ...	Stock	...	...	...	97 —100	95 —100	...	...
30,000	Callender's Cable Construction shares, Nos. 1—30,000 ...	5	15 %	15 %	...	17 — 18	17 — 18	17½	...
40,000	Do. do. 5 % Cum. Pref.	5	...	...	...	5½ — 6	5½ — 6	6	5 15/16
90,000£	Do. do. 4½ % 1st Mort. Deb. Stock Red ...	Stock	...	...	...	111 —115	111 —115	...	...
1,969,800	Central London Railway, Ord. Stock	Stock	...	...	4 %	103 —106	103 —106	105½	104½
440,100	Do. do. 4 % Pref. Stock	Stock	...	...	4 %	103 —106	103 —106	105⅝	...
440,100	Do. do. Def. do.	Stock	...	...	4 %	100 —103	100 —103.	...	...
855,000	City and South London Railway	Stock	1⅞%	1½%	2 %	70 — 72	72 — 74	73½	71½
54,000	Crompton & Co., Nos. 1 to 54,000	3	7½%	8 %	...	3 — 3½	3 — 3½	...	...
100,000£	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 red	...	...	...	...	103 —108 %	103 —108 %	...	...
99,261	Edison & Swan Utd. El. Lgt., "A" shares, £3 pd. 1 to 99,261	5	6 %	2½%	...	⅛ — ⅜	⅛ — ⅜	...	...
17,139	Do. do. do. "A" Shares, 01—017,139 ...	5	6 %	2½%	...	2 — 3	2 — 3	...	...
344,023£	Do. do. do. 4 % Deb. Stock Red ...	100	...	...	...	75 — 80	75 — 80	...	...
100,000£	Do. do. 5% 2nd Deb. Stock Prov. Certs. all pd.	100	...	...	...	82 — 87	82 — 87	...	...
112,100	Electric Construction, 1 to 112,100	2	6 %	6 %	...	1¼ — 1⅝	1¼ — 1⅝	...	...
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390... ...	2	...	...	...	2½ — 3	2½ — 3	...	...
182,500£	Do. do. 4 % Perp. 1st Mort. Deb. Stock ...	Stock	...	...	...	97 —101	97 —101	...	...
18,000	General Elec. Co. (1900) 5 % Cum. Pref.	10	...	...	...	9⅜ — 10¼	9⅜ — 10¼	10	...
150,000	Do. do. 4 % Mort. Deb.	Stock	...	...	...	98 —101	98 — 101	...	...
35,000	Henley's (W. T.) Telegraph Works, Ord.	5	15 %	20 %	20 %	17 — 18	17 — 18	...	...
35,000	Do. do. do. 4½ % Pref.	5	4½%	4½%	...	5½ — 6	5½ — 6	...	...
50,000£	Do. do. do. 4½ Mort. Deb. Stock...	Stock	...	...	...	111 —115	111 —115	...	...
50,000	India-Rubber, Gutta-Percha and Telegraph Works ...	10	10 %	10 %	...	21 — 22	21 — 22	...	...
300,000£	Do. do. do. 4 % 1st Mort. Deb	100	...	...	...	99 —102	99 —102	...	...
37,500	†Liverpool Overhead Railway, Ord.	10	3⅜%	3¼%	1½%	4⅞ — 5	4⅞ — 5	...	...
10,000	† Do. do. Pref., £10 paid	10	5	...	...	10½ — 11	10½ — 11	...	...
7,500	Parker (Thomas), Limited, Ord., Nos. 1 to 7,500	10	...	...	...	15½ — 16½	15½ —16½	...	...
	§Rosling, Appleby & Fynn 6 % Cum. Pref.	£1	...	6 %	...	... — ...	19/0 to 20/0	...	...
37,350	Telegraph Construction and Maintenance	12	15 %	17½%	20 %	34 — 37	34 — 37	36¾	...
150,000£	Do. 4 % Deb. Bds. Nos. 1 to 1,500 Red. 1909 ...	100	...%	...	...	103 —106	103 —106	...	...
25,000	Telegraph Manufacturing, Ord. Nos. 1 to 25,000	5	12 %	12 %	...	10½ — 11½	10 — 11 xd	...	...
20,000	Do. do. 5 % Cm. Prf. Nos. 1 to 20,000...	5	...	...	...	5½ — 6	5½ — 6	...	...
540,000£	Waterloo and City Railway, Ord. Stock	100	3 %	3 %	3 %	91 — 94	91 — 94	...	...

† Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § From Bradford Share List.

LATEST PROCURABLE QUOTATIONS OF SECURITIES NOT OFFICIALLY QUOTED.

Consolidated Telephone Construction and Maintenance, 1/16—3/16.
National Electric Free Wiring, —1.

Oldham, Ashton, and Hyde Electric (£10 pd.), Ord., 14½—15.
Do. do. Pref. (£10 pd.), 10⅜—10⅝.

* From Birmingham Share List ¶ From Manchester Share List.

Bank rate of discount 3 per cent. (February 6th, 1902).

MARKET QUOTATIONS, Wednesday, May 14th.

CHEMICALS, &c.		This week.	Last week.	Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	5/-	..
a „ Nitric	per cwt.	22/-	22/-	..
a „ Oxalic	per cwt.	32/-	32/-	..
a „ Sulphuric	per cwt.	5/6	5/6	..
a Ammoniac, Sal	per cwt.	42 -	42 -	..
a Ammonia, Muriate (crystal) ..	per ton	£33 10	£33 10	..
a „ „ ..	per ton	£30	£30	..
a Bleaching powder	per ton	£7	£7	..
a Bisulphide of Carbon	per ton	£15	£15	..
a Borax	per ton	£13	£13	..
a Bensole (90 %)	per gal.	7/-	7/-	..
a „ (50/90%)..	per gal.	5/6	5/6	..
a Copper Sulphate	per ton	£19	£19	..
a Lead, Nitrate	per ton	£24	£24	..
a „ White Sugar	per ton	£31	£31	..
a „ Peroxide	per ton	£27 10	£27 10	..
a Methylated Spirit	per gal.	2/6	2/6	..
a Naphtha, Solvent (90% at 160° C).	per gal.	5/6	5/6	..
a Potash, Bichromate, in casks..	per lb.	8d.	8d.	..
a „ Caustic (76/80%)	per ton	£24	£24	..
a „ Bisulphate	per ton	£85	£85	..
a Shellac	per cwt.	115/-	120/-	5s. dec.
a Sulphate of Magnesia	per ton	£4 10	£4 10	..
a Sulphur, Sublimed Flowers ..	per ton	£6 5	£6 5	..
a „ Recovered	per ton	£5 10	£5 10	..
a „ Lump	per ton	£5	£5	..
a Soda, Caustic (white 70 %) ..	per ton	£10 15	£10 15	..
a „ Crystals	per ton	£8	£8	..
a „ Bichromate, casks ..	per lb	2½d.	2½d.	..
METALS, &c.				
b Aluminium Ingots, in ton lots	per ton	£148	£148	..
b „ Wire, in ton lots	per ton	£224	£224	..
b „ Sheet, in ton lots	per ton	£191	£191	..
p Babbitt's metal ingots.. ..	per ton	£75 to £125	£75 to £125	..
c Brass (rolled metal 2" to 12") basis	per lb.	6¾d.	6¾d.	..
c Tube (brazed)	per lb.	8¼d.	8¼d.	..
c „ „ (solid drawn) ..	per lb.	7d.	7d.	..
c „ Wire, basis	per lb.	7d.	7d.	..
c Copper Tubes (brazed) ..	per lb	8⅝d.	8⅝d.	..
c „ „ (solid drawn) ..	per lb.	9d.	9d.	..
g Copper Bars (best selected) ..	per ton	£69	£69	..

METALS, &c. (*continued.*)		This week.	Last week.	Inc. or Dec.
g Copper Sheet	per ton	£69	£69	..
g „ Rod	per ton	£69	£69	..
c „ Electrolytic) Bars ..	per ton	£63	£63	..
c „ „ Sheets ..	per ton	£75	£75	..
c „ „ Rod ..	per ton	£68	£68	..
c „ „ H.C. Wire	per lb.	8d.	8d.	..
f Ebonite Rod	per lb.	8/-	8/-	..
f „ Sheet	per lb.	5/-	5/-	..
n German Silver Wire	per lb.	1/5	1/5	..
h Gutta-percha fine	per lb.	8/-	8/-	..
h India-rubber, Para fine	per lb.	8/1 to 8/1½	8/1 to 8/1½	..
t Iron, Charcoal Sheets	per ton	£18	£18	..
t „ Pig (Cleveland warrants) ..	per ton	48/6½	48/5	1½d. inc.
t „ Forgings, according to size	per ton	From £11	From £11	..
t „ Scrap, heavy	per ton	47/6 to 50/-	47/6 to 50/-	..
t „ Wire, galvanised No. 8 ..	per ton	£9 15	£9 15	..
g Lead, English Ingot	per ton	£11 17 6 to £12	£11 17 6 to £12	..
g „ „ Sheet	per ton	£18	£13 10	10s. dec.
m Manganin Wire No. 28	per lb.	8/-	8/-	..
g Mercury	per bot.	£8 15	£8 15	..
d Mica (in original cases), small ..	per lb.	8d. to 9d.	8d. to 9d.	..
d „ „ „ medium	per lb.	1/9 to 2/9	1/9 to 2/9	..
d „ „ „ large ..	per lb.	3/8 to 7/8	3/8 to 7/8	..
p Phosphor Bronze, plain castings	per lb.	11½d. to 1/2	11½d. to 1/2	..
p „ rolled bars & rods	per lb.	1/- to 1/8	1/- to 1/8	..
p „ „ strip & sheet	per lb.	From 1/2	From 1/2	..
o Platinum	per oz.	£4 1	£4 1	..
p Silicium Bronze Wire	per lb.	10d. to 1/-	10d. to 1/-	..
t Steel, Magnet, acc'd'ng to desc'p'n	per ton	From £15	to £40	..
t „ „ in bars		£58	£58	..
g Tin, block	per ton	£135 to £136	£131 to £132	£4 inc.
g „ foil	per lb.	1/6	1/6	..
n „ wire, Nos. 1 to 16	per lb.	1/9	1/7	2d. inc.
p White Anti-friction Metals — "White Ant" brand	per ton	£35 to £65	£35 to £65	..
j Yarns, 2/10s Grey Cotton, on sp'ls	per lb.	7d.	7d.	..
j „ 6 ea Flax	per lb.	5½d.	5½d.	..
j „ 3 oly 10 lbs. Russian ..	per lb.	5 1/16d.	4 15/16d.	..
j „ 10 lbs. Russian, single ..	per lb.	4½d.	4½d.	..
j „ 180 lbs. Jute rove	per ton	£10 2 6	£10 2 6	..
k Zinc, Sh's. (Vielle Monta,ne brd.)	per ton	£22 10	£22 10	..

Quotations supplied by { a Messrs. G. Boor & Co. b The British Aluminium Co., Ltd. c Messrs. Thos. Bolton & Sons. d Messrs. F. Wiggins & Sons. e Messrs. Frederick Smith & Co.

Quotations supplied by { f India-Rubber, G.-P. and Teleg. Works g Messrs. James & Shakspeare. [Co., Ltd. h Messrs. Edward Till & Co. t Messrs. Bolling & Lowe. j Messrs. Walter H. Hindley & Co.

Quotations supplied by { k Messrs. Morris Ashby, Limited. m Messrs. W. T. Glover & Co., Ltd. n Messrs. P. Ormiston & Sons. o Messrs. Johnson, Matthey & Co., Ltd p The Phosphor Bronze Company, Ltd

INSTITUTION OF ELECTRICAL ENGINEERS.

SOME NOTES ON POLYPHASE MACHINERY.

By A. C. Eborall.

(Paper read at Manchester, March 25th, 1902.)

(Continued from page 793.)

In connection with the above remarks on parallel running and fly-wheel effects, &c., the author thinks it might prove of interest to refer very briefly to a plant in which he has lately taken considerable interest, as there are several novel features connected with its design and operation. Fig. 7 shows the general arrangement of a 600-H.P. gas-driven three-phase generator, which runs perfectly in parallel with two steam-driven generators built by the same maker in the power station of a large Bohemian steel works. The gas engine is of the Cockerill type, having two pairs of tandem cylinders, and two explosions per revolution; it is supplied with gas (from the blast furnaces) having a heat value of about 2,000 calories, which is carefully cleaned before reaching the engine—one of the most important points connected with the successful operation of such plants, as far as the engine is concerned. The speed of the set is 150 revolutions per minute, the frequency 25 cycles, and the generator has its armature winding in two holes per pole per phase, the pole-shoes being solid and cast with the steel pole-cores.

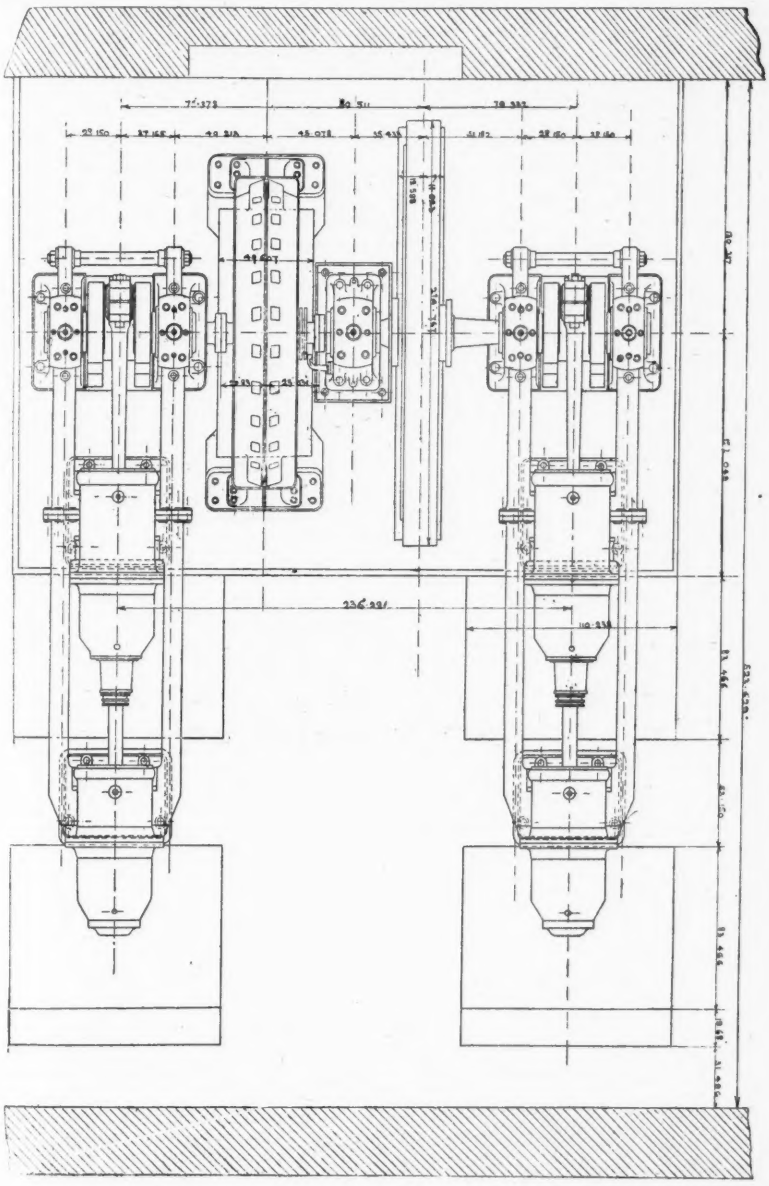


Fig. 7.

The chief features of interest in this plant are the special arrangements made for putting it into parallel with the steam generators, and for ensuring successful parallel running afterwards. In connection with this, it may be mentioned that the engine was delivered in two portions—one side, consisting of a pair of tandem cylinders, together with the generator, being delivered and set to work first. Under these conditions the cyclic irregularity of the combination was about 1 in 130 at full load (300 H.P.), but later on, when the other half of the engine was put to work, this decreased to about 1 in 200 at the full load of 600 H.P.; no difficulty whatever was found in operating the plant in parallel with the steam generators under the first-mentioned very severe conditions.

When connecting the gas generator to the bus bars supplied by the steam generators, a choking coil and an artificial load are used. The latter does not consist of a resistance connected to the generator, but of a special eddy current brake* acting on the fly-wheel, having a maximum braking effect of about 300 H.P. Fig. 8 gives the details of this arrangement. For work of this character, an artificial load of some sort is an absolute necessity, as an unloaded gas generator cannot be brought up to speed and thrown on the bus bars—the brake in question absorbs only a trifling amount of energy from the direct current mains, requires no additional space, can be regulated with ease and accuracy, and is an excellent mechanical job. Both the brake and the choking coil are put out of use as soon as the gas generator is working on the load; the (three-phase) choking coil is adjustable, and its function is simply to limit the synchronising currents which occur during the adjustments. Fig. 9 gives the connections for the gas generator and for one steam generator, which require no further comment.

The governors of the steam engines can be controlled from the switchboard by means of small three-phase motors, actuating the governor gear, and the speed of the steam engines can thus be completely controlled by the switchboard attendant when the sets are running. A special point connected with the design of the generator driven by the gas engine is that the reaction of its armature is purposely arranged to be much higher than that of the armatures of the steam generators. Thus, on account of the pressure drop of the gas generator being, in comparison, considerably larger, the load on the latter remains nearly constant, the governors of the steam generators dealing with the variations of load—in fact, the regulation of the plant is performed by the steam engines.

The kinetic energy of the revolving magnet wheel of the generator at the normal speed is 360 foot-tons, but as a total kinetic energy of 5,000 foot-tons is required, a separate fly-wheel is required to provide the large difference. The fly-wheel provided was made on the spot; it weighs 24 tons, the outside diameter being 18 ft. The peripheral speed of the rim is thus about 8,500 ft. per minute at the normal speed, which is a value that only the best Siemens-Martin steel can safely stand; it is for this reason that the fly-wheel is made of this material throughout.

The enormous fly-wheel effect of 5,000 foot-tons required by the gas engine, in order that the cyclic irregularity already mentioned might not be exceeded, corresponds approximately to the amount that would be required by a well-designed two-crank steam engine of 1,700 H.P. running at the same speed and having the same cyclic irregularity. It is clear that such a very large fly-wheel effect could not be put into the generator magnet wheel without seriously affecting the quality of the design of the generator, and as such values are a characteristic feature of large gas generators, separate fly-wheels are always arranged for in such plants, as already pointed out.

The exciter for the gas generator described above is separately driven; this is a necessity in such cases, in order to prevent the variations in the exciting current that would take place if the exciters were direct coupled to the generators, which would affect the pressure regulation and perhaps the parallel running as well.

This part of the paper may be concluded with a note on the method of specifying fly-wheel effects generally used in this country. The author ventures to suggest that a much more convenient way might be found of expressing the fly-wheel effect than that usually employed (the kinetic energy in foot-tons), which

* The use of an eddy current brake for such a purpose was first proposed by Mr. Dettmar, of Hanover.

includes a speed term and the value of gravity. The dynamo constructor having to provide a certain fly-wheel effect in the magnet wheel of his generator, the value of which is given to him by the engine builder, does not require either of these terms for his calculations; all he cares about is the diameter and weight of the magnet wheel. Under present circumstances, he is given a value of $\frac{M V^2}{2}$, from which he deduces the product $W D^2$, and although it is of course a small matter, yet nevertheless time is wasted, owing to the inconvenience of the expression. This might be prevented by using a more rational expression for the fly-wheel effect, such as the simple product found above, namely, the weight of wheel, multiplied by the square of the diameter of gyration.* This would be written shortly as $W D^2$, and would be described in foot²-tons. It is certainly more correctly described as a fly-wheel effect than $\frac{M V^2}{2}$, and the value is of course proportional to the cyclic irregularity. Thus, if the engine builder tells the dynamo maker that his magnet wheel must have a value of $W D^2 = 10{,}000$ foot²-tons, in order that the cyclic irregularity of the engine in question may not exceed 1/200, the dynamo maker knows at once that if he wants a better speed regulation in the revolution than this, he must increase this value in proportion to his requirements—if, for instance, a cyclic irregularity of 1/400 is wanted, then 20,000 foot²-tons must be arranged for.

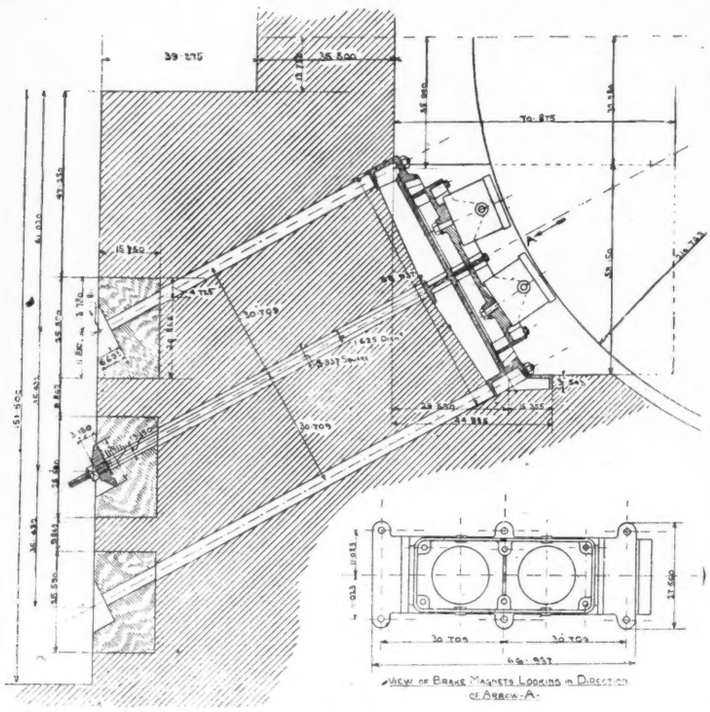


Fig. 8.

The advantages of this expression to the dynamo maker from the point of view of all round convenience are obvious; the expression is moreover quite convenient to the engine builder, as he can use it directly in his calculations, the actual diameter of the magnet wheel being immaterial to him. There is the further advantage that the simple expression $W D^2$ conveys an actual mental impression of the dimensions of the fly-wheel to both parties, which is certainly not the case with the expression $\frac{M V^2}{2}$.

On account of these considerations the author hopes that those interested will give the suggestion their consideration, with a view to standardising the expression $W D^2$ for use in every-day practical work. The term "fly-wheel effect" would then have the perfectly definite meaning for every-day work which it lacks at present.

(To be continued.)

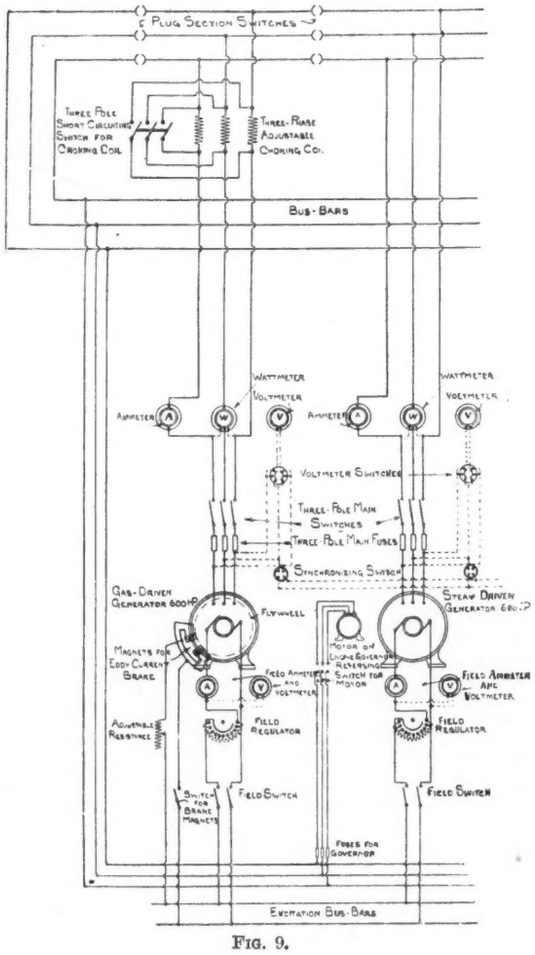


Fig. 9.

PHYSICAL SOCIETY.

Ordinary Meeting held April 25th, 1902.

Prof. S. P. Thompson, President, in the chair.

Dr. Dawson Turner exhibited and described "A Mechanical Break for Induction Coils," consisting of two metallic rollers, with their axes parallel, and kept in contact by a spring. One of the rollers has a cam attached to its spindle, and can be made to rotate by means of a small electric motor. Once in each revolution the cam separates the rollers, thus making the break, and at the same time causing the second roller, which rides loose upon its axis, to turn about one-eighth of a revolution. As soon as the cam has passed, the rollers are brought into contact by the spring, and the next break occurs at a different place. The wearing is thus distributed evenly over a large surface. The break is placed in a box containing alcohol or petroleum, and works best when rotating rapidly. An objection to the arrangement is the noise it makes when working. Some experiments were then shown on the discharge of electrified bodies by ultra-violet light. A disadvantage of the electric arc, when used to furnish ultra-violet light for use in medicine, is that the light is accompanied by heat, so that it is necessary to shield the patient from the heat, without interfering with the passage of the light. A condenser spark between iron electrodes is useful, because it gives a large amount of ultra-violet radiation without much heat. Dr. Turner showed that this light is capable of discharging bodies, whether positively or negatively electrified. He then showed that glass and mica are opaque to the radiation, while pure rock salt is transparent.

Mr. Wilson Noble exhibited a mechanical break similar to the one already shown. A roller and a disc, with their axes parallel, are placed in contact, and made to rotate in the same direction by a motor. Longitudinal slots are cut upon the surfaces of both, and the break occurs when a slot in the roller comes opposite a slot in the disc. Since the two are moving in opposite directions at their point of contact, the break is very sudden. To vary the length of the break without altering the rate of rotation, the slot in the roller

* The equivalent expression, namely, $G D^2$ (meter²-kilos) is a standard expression all over the Continent for the fly-wheel effect. The kinetic energy of the wheel in foot-pounds is equal to $\frac{G D^2 \times n^2}{1{,}000}$, where n is the speed in revolutions per minute.

is wider at one end than the other, and the disc can be placed so as to touch the roller at any point of its length.

The Chairman said he knew of no metal which would withstand continual sparking without wearing, and suggested that breaks should be so designed that the parts affected by the sparking could be easily replaced. He asked if there was any difference in the wear of the two rollers. Referring to an experiment shown by Dr. Turner, in which ultra-violet light discharged a positively electrified body much quicker than a negatively electrified one, he asked if this would be the case if the apparatus were surrounded by an earthed metallic screen.

Mr. Watson suggested that the wearing of the edges in Mr. Wilson Noble's break might be lessened by filling the cavities with slate.

Mr. Duddell said that the worst substance for making contact pieces was carbon; then came zinc, brass and copper, with platinum best. These were the results in air, but the effects in liquids were different. With rapidly moving contacts all metals are equally good, but in ordinary coils the contact pieces move slowly.

Dr. Dawson Turner said that if the experiment referred to by the Chairman had been performed inside an earthed metallic screen, the negatively electrified body would have been more quickly discharged.

Mr. R. S. Whipple exhibited "A Temperature Indicator for use with Platinum Thermometers, in which readings are automatically reduced to the Gas Scale." The indicator consists of a simple Wheatstone bridge with equal ratio arms, the other arms being the thermometer and a long helical bridge wire, together with the compensating leads. A travelling contact is moved round the wire until a balance is obtained. The bridge wire is wound on an ebonite drum, on the outer surface of which a helix has been cut. The contact piece, which is connected electrically with the galvanometer, is carried from the inside of a cylinder fixed to a shaft. A white celluloid tube on which the scale is divided, is fixed to the outer surface of the cylinder. A screw of the same pitch as the helix on the ebonite drum is cut on the shaft so that by rotating the shaft the contact is caused to travel along the bridge wire, and at the same time the scale is carried past an index placed above it. The scale has been so constructed that the reading at the index gives directly the temperature of the thermometer reduced to the gas scale. The instrument reads from 0° to 1,400° C.

Dr. Chree asked the following questions:—Was not the instrument so constructed restricted to platinum thermometers of wire having a given specified value of δ; if so, what was this value? Did the helical wire balance the entire resistance of the thermometer, or only the excess above the resistance at 0° C.; and could the instrument measure temperatures below 0° C.? What error was likely to come in when measuring temperatures up to 1,000° C. from changes in the resistance of the helical wire under the variations of atmospheric temperature to which it would be exposed in ordinary use? Would not there be some wear between the wire and the contact piece?

Dr. Harker asked what were the limits of the value of δ for wires now supplied for commercial purposes. He thought that the accumulation of dust between the contact piece and the wire, due to continual scraping, was a more serious objection than the wearing away of the wire.

Mr. Whipple said the scale was calculated for a value of $\delta = 1{\cdot}5$. The value of δ seldom exceeded 1·52, and wire could be obtained with $\delta = 1{\cdot}5$. The instrument shown was made to read from 0° C., but could be easily arranged to read below 0° C. The wearing between the contact piece and bridge wire was very slight.

Mr. S. A. F. White read a "Note on the Compound Pendulum." The Society then adjourned until May 9th, 1902.

ELECTRIC TRACTION.

[Paper read at the Town Hall, Northampton, before the Tramways Committee and others.]

By PHILIP DAWSON.

(*Continued from page* 789.)

The tramways which have now been converted entirely to electric traction carried 188,000,000 passengers in 1899, as against 306,000,000 in 1901. To give an idea of the total amount of power which will have to be installed, Tables VIII., IX. and X. may be of use. From Table VIII. the amount of power per car-mile run can be ascertained. It may be stated here that, for rough estimating purposes, it is safe to take 1 B.O.T. unit per car-mile for the conditions which generally obtain in this country. Tables IX. and X. show the amount of power installed in various German and British stations per motor car operated, and per mile of route. For rough estimating purposes, it may fairly be said that approximately 10 kw. per car operated should, under normal conditions, prove sufficient.

The question of laying down a proper power station which will economically supply electricity for traction purposes, is a very important one, and as the conditions that obtain in traction are entirely different from those which are met with in lighting work, a station eminently well designed for lighting purposes will generally be uneconomical for traction work. Electricity has been used commercially for lighting during the last 20 years, but the amount of power used for generating purposes would not be excessive, even if electric light were to supersede all other methods of illumination. The hours during which light is required every day are restricted, and the generating plant has to be idle the greater portion of the 24 hours, hence even with the most careful study of the conditions that obtain, it is generally impossible to lay down a purely lighting plant which can produce electricity at all economically. The load on a station used only for lighting is very uneven, increasing from an insignificant amount most of the day to a very heavy demand for a few hours in the evening. Furthermore, the demand in winter and in summer is very different, and the maximum load in winter may attain proportions necessitating a plant which will lie idle most of the year. These conditions call for a large number of units of varying sizes, and it is often essential to have as small a first outlay as possible, as no economy in working can make up for the loss due to the capital which lies unproductive for relatively long periods, and for the waste due to maintaining steam and keeping the engines hot. This accounts for the heavy price which we have to pay for our electric lighting.

Table VIII.

Name.	Max. grade.	Average B. of T. units per car-mile.	Average speed miles per hr.	Lbs. of coal per car-mile.
Aix-la-Chapelle ...	1 in 11	·589 to 1 236	8	3·5 to 6 9
Hamburg	—	·902	6 to 12	3·21
Brussels — La Petite Espinette...	1 in 25	1·2 (heavy cars)	16	4·6 to 4·9
Glasgow	1 in 14	1·370	6	8
Bristol	1 in 15	1·000	8	7

Table IX.—German Power Stations.

Name.	Mean grade.	Number of motor cars.	Number of trail cars.	Total capacity in kw. of station.	Battery cap in ampere-hours.	Total station capacity per kw., including motor car.	Total power, including spares per mile of single track.	Cap of cells in ampere-hours per motor car.
Bochum ...	1·20	32	32	400	165	9·3	12	4·1
Dortmund	1·25	36	32	375	264	8	28	5·5
Plauen ...	1·20	13	—	144	100	11	32	7·7
Horder ...	1·14	30	15	300	277	8·5	25	8
Coblentz...	—	29	—	3 0	—	10·4	—	—

Table X.

Name.	Total station capacity kw.	Total track length.	No. of motor cars.	Total station capacity.	
				Per mile of track.	Per motor car.
Bristol	2,000	52	200	38	10
Dover	200	4·5	16	44	12
Dublin United...	3,000	74	240	40	12·5
Halifax... ...	600	15·25	42	39·4	14
Liverpool ...	7,200	114	441	63·2	16·3
London United	3,000	26	150	77	13·3

The extensions in the uses of electricity have naturally influenced the design of the power house. Electric light was the first comer, and the plants laid down were as far as possible designed to fulfil the special conditions required in lighting. Thus up till quite recently, with the exception of those who have grown up with electric traction, practically all electrical engineers who were not telegraph men were lighting engineers. When electric traction began to come into use many stations were consequently designed as though intended for lighting. Indeed, it was not till electric tramways had been in operation some time that it was discovered by costly experience that what was right for electric lighting was out of place in traction work. A few moments' consideration will show that this result was inevitable by reason of the widely different demands. An electric lighting station, as we have seen, only works for a comparatively short time every day, and the load, though varying, is more or less steady. On the other hand, a traction plant works nearly continuously, and the load is scarcely ever steady for two consecutive minutes, due to cars starting and stopping. It is not an infrequent occurrence for a considerable number of cars to start simultaneously, thus putting a heavy overload on the generating units. The capital expenditure in the case of a traction installation is much greater than in the case of a lighting plant, and the long hours of working render the question of labour and fuel consumption of the very first importance. The

practice is now coming in of designing stations to supply power for all purposes. When this is done at the commencement a very good station can be obtained, but where existing lighting stations are utilised the results are generally far from satisfactory. This appears to have been generally admitted, and except when a new station designed for traction and lighting work was being laid down, special plants have been put down. As examples we may take Glasgow, Leeds, Newport, &c. In the case where an old lighting station exists and power is required for traction work, in nine cases out of ten there is but one thing to do, and that is, to instal an entirely new plant, with the possible exception of boilers, for the traction work. This method may appear drastic, but it is the most economical in the end. The whole question of cheap power supply depends upon the station being properly laid out, so as to adequately fulfil the conditions required, and to secure as good a load factor as possible. It may be well to state here that by load factor is understood the ratio of the actual B. of T. units measured at the switchboard in the power station to the amount which would be generated if the plant ran continuously at the maximum load which it is at any time called upon for. Table XI. has been prepared from an article written for *Traction and Transmission* on the important question of the standardisation of power stations, and it will be seen from this table how much importance attaches to getting a high load factor.

TABLE XI.—INFLUENCE OF LOAD FACTOR ON COST OF GENERATION.

STATION OF AT LEAST 2,000-KW. CAPACITY.

Load factor. Per cent.	Cost per unit generated, pence. Fuel at 10s. per ton.	Total.
10	·6	1·0
15	·5	·78
20	·4	·56
25	·35	·45
30	·32	·4
35	·3	·35
40	·26	·33
45	·25	·3
50	·24	·28
60	·22	·25
70	·19	·24
90	·16	·23

These costs do not include interest and sinking fund, but they do include maintenance and repairs in the generating station.

LOAD FACTORS USUALLY OBTAINED.

	Per cent.
Ordinary town lighting, with no motor load	10
Lighting goods yards and railway lighting generally	15—20
Cotton mills and ordinary engineering works, working in daytime only	25—30
Ditto working double shifts	35—45
Coal mines under favourable circumstances	40
Traction	15—30

TABLE XII.—RATES CHARGED TO ORDINARY CONSUMERS BY THE CATARACT POWER AND CONDUIT COMPANY.

1,000 units or less per month	1·00d. per unit.
1,000 units up to 2,000 units per month	0·75 "
2,000 " " 3,000 " " "	0 60 "
3,000 " " 5,000 " " "	0 50 "
5,000 " " 10,000 " " "	0·40 "
10,000 " " 20,000 " " "	0·375 "
20,000 " " 40,000 " " "	0 35 "
40,000 " " 80,000 " " "	0·33 "
80,000 " " 200,000 " " "	0·32 "

TABLE XIII.—PRICES PAID BY TRAMWAYS FOR ELECTRIC POWER.

Supplying station.	Tramway.
Blackburn, 1·5d.	Blackburn Corporation.
Plymouth, 2·3d.	Plymouth Corporation.
Ashton-under-Lyne, 4·5d.	Oldham, Ashton and Hyde.
Cheltenham, 2·0d.	Cheltenham Tramway Co.
Hamburg Lighting Co., 1·0d.	Hamburg Tramway Co.
Geneva Corporation, 1·0d.	Geneva Tramway Co.

It is evident that a lighting load by itself can under no conditions be favourable to a good load factor. It need hardly be pointed out that before proceeding to lay down the station the question of what load factor can be secured should be most thoroughly investigated.

It has been assumed by many that where free water power is available electrical energy can be generated very cheaply; this, however, is not always the case, as the capital required to harness the water power is often so great as to more than outweigh the saving in cost of production. Thus the electrical energy generated at Rheinfelden, at Zurich, and according to Mr. Kershaw, even at Buffalo, costs more than it would if generated in the coalfields of England in large central stations by steam power. In the case of Zurich, the city engineer stated to me that notwithstanding the high cost of fuel (frs. 30 –35 a ton), the only way to cheapen the cost of production was to increase the steam plant, which at the present moment generates electrical energy approximately at $\frac{2}{3}$ths what it costs to do by water power. In this connection Table XII., giving the price of selling electrical energy at Buffalo, as supplied from Niagara, may be of interest—it will be seen here, that for amounts exceeding 80,000 units per annum the price charged is less than $\frac{1}{2}$d; when we compare this to Table XIII., which gives some of the prices charged for electrical energy for traction purposes, it is remarkable that, under the high rates charged for electrical energy, electric tramways should be able to exist, except where they generate their own supply of power. Table XIV. gives some very interesting results of the Leeds Tramways; it will be seen that the cost of power, which does not include sinking fund or interest, is very low, and that the results generally obtained are most satisfactory.

TABLE XIV.—LEEDS CORPORATION ELECTRIC TRAMWAYS.

(Year ended March 25th.)

	1900.	1901.
Total electric car receipts	£63,436 10 5	£133,449 11 5
Total car mileage	1,205,812	2,506,655
Receipts per car-mile	12·62d.	12·77d.
Working expenses per car-mile	5·97d.	6·49d.
Ratio of expenses to receipts	47·3 per cent.	50·8 per cent.
Cost of generation per B.O.T. unit	·82d.	·67d.
Total units generated	1,095,231	2,452,741
Supplied to arc lamps, shed lighting, &c.	59,682	190,251
	1,035,549	2,262,490

(To be concluded.)

THE INST. E. E. AND THE FACTORIES AND WORKSHOPS ACT, 1901.

A CONFERENCE convened by the Council of the Institution of Electrical Engineers was held last Monday afternoon at the rooms of the Society of Arts, to consider what steps, if any, should be taken in reference to the Factories and Workshops Act of last year. There was a large and thoroughly representative gathering, composed of the responsible officials of the principal corporations and companies engaged in the business of electricity supply.

Mr. Langdon, the President of the Institution, presided, and explained the present position of affairs. The conference had been called at comparatively short notice in order to take steps to lay before the Home Secretary the wishes of the industry, in reference to the framing of the regulations regarding the inclusion of electrical generating and transforming stations as non-textile factories under the new Act. He pointed out the effect of this inclusion as regards the employment of young persons under the age of 18, and also with reference to inspection, and stated that while it was the duty of the State to protect the rights of its citizens, we were a commercial nation, and these rights should be guarded in such a manner as not to unduly hinder us in our competition with other nations. The electrical industry was destined to prove of the greatest value to the country, and care should be taken that it was not hampered by unnecessary restrictions. The regulations for non-textile factories, though profitable and helpful to other industries, were wholly unsuitable for electrical generating and transforming stations, and since the sole power of modifying them was vested in the Home Secretary, it was necessary that definite steps should be taken in approaching him on the matter before he issued the final regulations.

Mr. McMillan then read a summary of the replies which had been received from central station authorities in answer to the questions asked by the Council. The majority were of opinion that the new proposals would be harmful to the industry, and were in favour of immediate action. Several letters were also read from representatives of electrical supply undertakings, regretting their inability to be present.

Major-General Webber pointed out that the matter was now daily becoming more important. The final regulations were not yet issued, but the Home Office had appointed an electrical inspector of factories, so it was evident early action in the matter was in contemplation. He was representing at that conference the London Chamber of Commerce; they had endeavoured, but without avail, to get electrical stations excluded from the operation of the Act, while it was yet

under the consideration of Parliament. He only hoped that it was not now too late to obtain those modifications and exemptions from the provisions of the Act, which were necessary to prevent it being burdensome to the industry.

Mr. Percy Still proposed the following resolution:—

"Resolved—that in the opinion of this Conference there are clauses in the Factories and Workshops Act of 1901 that are prejudicial to the industry of electricity supply."

Basing his arguments upon the manner in which the operation of the Act would affect the employment of young persons, he stated that at Chelsea they had a number of sub-stations containing motor-generators. It was their practice to place during the greater part of the time one capable workman attendant in each of these stations. During the hours of heavy load they found it advantageous to give each of these men an assistant, usually a youth between 16 and 18 years of age. This youth was not in a responsible position, but simply obeyed instructions. This experience proved very valuable to the youth, for it gave him an opportunity of qualifying for a position as switchboard or dynamo attendant. Since the usual regulations for non-textile factories forbade the employment of young persons under 18 other than between the hours of 6.0 a.m. and 6.0 p.m., or 8.0 a.m. and 8.0 p.m., and at the same time prohibited their taking meals on the premises where work was carried on, it followed that in future these youths would be debarred from employment in this direction, to their own disadvantage, as well as the inconvenience of their would-be employers. The conditions under which these youths worked were in every way satisfactory, and he trusted that the united action of the industry would result in attendants of this character being exempted from the operations of the Act. His company had been in communication with the deputy-inspector of factories on the matter, and had been informed that applications for exemptions from individuals would not be entertained, but that every consideration would be given to representations made on behalf of the whole industry.

After Sir Henry Mance had seconded the resolution, Mr. Gay drew attention to some of the other liabilities imposed upon electrical undertakings by the Act, such as making the manager responsible for the supply *and use* of rubber gloves by the workpeople. It was possible to take a dog to the water but not to make him drink; and similarly you might provide rubber gloves and give instructions they should be worn, but the manager could not personally be in several places at once seeing if all the workers complied with his orders.

Several speakers then asked whether generating and transforming stations came under the clauses of the Act requiring them to be periodically whitewashed. There seemed to be considerable difference of opinion as to whether or not they had been officially exempted, though the absurdity of the proposal in view of the large number of glazed bricks in use was universally admitted.

This resolution having been unanimously passed, Mr. Raworth proposed:—

"That the Institution of Electrical Engineers be requested to take steps to approach the Home Secretary in order to lay before him the views expressed at this Conference as to the prejudicial effects of the incidence of certain provisions of the Factories and Workshops Act of 1901 on the industry of electricity supply, and to pray him to allow the Institution to confer with him when he is framing regulations under the Act."

In recommending this resolution for adoption by the Conference, Mr. Raworth feared that our legislators had obtained an entirely erroneous idea as to what an electric light or power station really was. He thought many of those present would agree with him that some of them far more resembled a cathedral than a factory, and as to their suitability for taking meals in, one could as comfortably dine in many of our modern examples as at the Holborn Restaurant. If it were not too practical a proposal, he would suggest that the Government go and see for themselves what our stations really were like.

As to the employment of young persons under 18, he considered that this was desirable in their own interests. The want of the industry, in his opinion, was educated skilled working men. To get these we must train them, and this could best be done during the receptive period prior to 18 years of age. It would be a real hardship to the industry if, owing to the conditions under which it was compelled to carry on its work, it were debarred from training its future workers in the practical field of experience.

Mr. Hammond, who seconded the resolution, expressed the opinion that the Conference was 12 months too late. Had it been held earlier it might have done more good. He feared what would be the result of the Act in regard to the inspection of our stations. Take, for instance, high tension switchboards; to comply with what were understood to be the latest Home Office requirements, would mean the reconstruction of the vast majority of the switchboards in use in the country, and whether or no the proposed new designs would be safe was open to doubt. He knew that in the opinion of many qualified to judge, the proposal to *cover up* all high tension connections met with little favour. He urged the conference to press to be heard, and it was possible that the Home Office would defer to the opinion of the Institution.

Mr. Chamen, speaking, he explained, as a private individual, wondered why the work of framing regulations for the control of electric generating and transforming stations should be taken out of the hands of the Board of Trade, who did understand the requirements of the industry, and be placed in the hands of the Home Office, who had to gain this experience in the future. He thought it would be impossible without actual experience of the directions in which the Act unfairly hampered the industry, to do very much, but he in the meantime supported the resolution.

The remaining speakers gave examples of the new demands of factory inspectors in such directions as remodelling switchgear, placing wooden guards round commutators, and otherwise interfering with the technical details of working.

Like its predecessor, this resolution secured unanimous acceptance, and in answer to a question, Major-General Webber stated that it was proposed to hold further meetings on the matter as occasion required.

Mr. Langdon, in closing the conference, referred to the value of the assistance young persons could intelligently and safely render in central station work, and hoped the result of the representations to be made to the Home Secretary would be satisfactory to all concerned.

This conference concluded with votes of thanks to the Chairman, and also to the Council of the Society of Arts for the use of the room.

THE BRITISHER ABROAD.

Whilst we may not entirely agree with the enterprising and energetic drummers from "across the pond," whose mission is to convince us that our only means of salvation as merchants and manufacturers are the adoption of American methods and means, and the purchase of American machinery, after having first consigned our own to the moral and material scrap heap—still, a little study of some of those old and cherished institutions, apart from our factories, which we fondly imagine are the bulwarks of our foreign trade and commerce, will convince us that there are some to which this application of the scrap heap theory will result directly in benefit to ourselves, and indirectly in loss to our competitors.

Take, for instance, our Consular, or, as it is often termed, Diplomatic and Consular Service, abroad. Whether this title denotes two distinct functions, or a blending of both, is not well understood by the general world; at any rate, not in the so-called "Far East."

If both consular and diplomatic functions are vested in the same individual, as is generally believed, then we have no hesitation in affirming that the sooner they are radically severed, and consular duties relating to the requirements of our merchants and traders more clearly defined, the more speedily we shall be assured of our position, we had almost said commercial supremacy, abroad.

We are glad to assert that our Consuls as a class are gentlemen by birth and education, staunch patriots, jealously and zealously upholding the honour and prestige of their

country at the risk of their lives when necessary, and shining examples to those of their nationals whose highest social ambition is to bask in the sun of consular recognition.

The British Consul in full gold laced uniform is a subject for irreverent chaff by the favoured few who know him socially, of reverent awe to those who only know of him officially, and a source of profound wonderment and curiosity to the benighted native, official and proletariat.

He is commonly supposed by his nationals to be under strict instructions from the Foreign Office to do nothing which may in any way increase the burden of correspondence, and to consider no occurrence short of positive danger to life to be of sufficient importance to merit his official interference or even personal notice. Hence originates the belief, apparently borne out by decades of disappointing experience, that nothing less than the murder of a missionary will galvanize a Consul into action, for he will be judged at home and his promotion assured, not by the maximum of work he does to develop the trade and commerce of his country, but by the minimum of trouble he gives to his chiefs at the Foreign Office.

His exertions are therefore confined chiefly to the compilation of the conventional Consular Report, the contents of which all whom it concerns commercially have already mastered by perusal of the published reports of local Chambers of Commerce, Customs, and banking returns, brokers' circulars, and other business issues.

Beyond this, the British merchant is blessed in his non-expectance of consular effort in his behalf.

Of the so-called "Consular Court justice," the writer, who has had over 30 years' experience in the Far East, asserts that it is rather avoided than sought, the merchant preferring to trust to such inducements as he himself can bring to bear on those concerned to obtain a more just recognition of his rights than he might hope to expect from his Consul's decision.

The belief is apparently well grounded on fact, that as a defence of their refusal of assistance in the execution of a perfectly legitimate commercial enterprise, Consuls have advanced the theory that "it is beneath the dignity of the position of H.B.M.'s representative to tout for private interests."

This creed also finds justification when a Consul tells a suitor for advice and assistance in a case of breach of contract by native officials; "Mr. Subject, according to our law your contention is a good one; according to native usual custom and ancient precedent, which is their law, I know you are right; and personally I am quite in sympathy with you, but *I* should not like to say so officially!"

Do we not require Consuls with a great deal more strength of conviction and official courage, and a great deal less dignity, or with such a regard for it that their nationals need never be compelled to seek the assistance of another nation's representative, who secures for him immediately a justice which his own Consul fears to even officially acknowledge as due?

Or what gold-laced uniform can give prestige to a Consul whose decision in favour of a native plaintiff against a national for claim and costs is reversed next day by the native magistrate of a mixed court, who orders the plaintiff at once to apologise, refund, and restore, under pain of severe flogging, all he had had awarded him in the Consular Court?

Our Consuls usually are gentlemen of education and common sense, speaking more or less the language of the native, and more or less experienced in his traditions and ways of thought. How, then, can we explain absence of Consular action in commercial matters, save by attributing it either to an egregiously mistaken idea of their own importance and duties generally, or to definite instructions from home to do nothing which may promote discussion between foreigner and native?

Good authority defines a Consul as "a person commissioned to reside in a foreign country as an agent or representative of a Government, to protect the rights of commerce, merchants and seamen of the State, and to aid in any commercial, and sometimes in diplomatic, transactions with such foreign country." If our Consular service is based on this definition, then its constitution is such that it hampers instead of promotes commerce. A Consul should be absolutely detached from all connection with diplomatic or other duties or responsibilities which may, in the least degree, impede his freedom of action in the interests of trade. He should be less an icon for the veneration of his nationals and be more in intimate touch with them and their requirements. Instead of remaining in a spurious dignity of inaccessibility, he should be in the front of all commercial movements, ready at once to lend aid to all seeking either advice or assistance for the furtherance of any legitimate enterprise; and, moreover, should be of so keen a business sagacity as to be able to obtain from the native officials such information as to Government contracts and official intentions as would lead to our profiting by them if possible. At the same time, he should be of such sterling integrity that his connection with any contract would be a guarantee of *bonâ fides* both of foreigner and native. Such men need not be sought afar. Some already exist in the Consular service, others can be found outside it.

They should enjoy the ægis of their Government, to whom they would be amenable. They should be well housed, and paid a good salary, and, in addition, emoluments proportioned to the annual increase in the trade of the country. Their tenure of office should be determinable at will by either side, and the continuance of their appointment and preferment absolutely dependent on results.

That there is urgent need for some drastic change in the action of our commercial Consulates is beyond doubt. That some means must be found to afford relief and assistance to our merchants if they are to successfully compete with the rest of the world is equally certain. The impediments which require removal we have already indicated; let us now see how their non-existence works in the Consular service of other countries.

We will take as an example Korea, a country where, if anywhere, our commercial status should be pre-eminent, but is *nil*. It is a new country just opening, with a perfect climate, enormous mineral wealth, a quiet, honest, sensible and friendly people, who, when paid, are as energetic workers as any in the world. There are immense agricultural and breeding possibilities, with hundreds of miles of sea coast. Its commercial relationships with other countries stand thus:—Japan first, then America, France, Germany, and England nowhere. Japan is naturally first on account of her naval and military occupation, her proximity, and her natural domination over a weaker people. The Japanese have postal and telegraph lines of their own, they own the only line of railway at work, some 30 miles in length, and another of some 300 miles in progress. They have all the coast, freight, and passenger, and a good three-fourths of the international marine traffic, as well as vigorous and flourishing settlements at each port they serve, and their latest acquisition is the establishment of the Corean Coast light service, for the commencement of which the Government has set aside seven millions of dollars.

The Americans built and equipped the only line of railway now running. They have, and are working, most valuable mining concessions covering an area three times larger than any other granted. They own the electric tramways of Seoul, and are building extensions for the use of the Imperial household; they own and work the electric lighting of the Imperial city, all worked by the largest electrical installation in Asia, they have the telephone concession for the whole Empire, they have the contract for the city waterworks, and it is stated, *sub rosa*, control the native bank and mint which coins the money to pay themselves with, besides various ramifications of influence in directions as yet undivulged.

The French and Germans have every available post worth having which can be granted by the Imperial household, mining concessions, and contracts for arsenals, rice, horses, &c.

The English have an imposing Consulate and Legation, a mining concession, and one, perhaps two, schoolmasterships of secondary importance. And that is all.*

This great difference between the relative shares of

* It is true that an Englishman, Mr. J. McLeavy Brown, is in control of the Imperial Customs revenues, but his devotion to his work is so honest and thorough, that his nationality is immaterial.

England and America in Korea's trade is not due to superiority of material, cheapness of construction, or time required, but to superiority in method and practice of the American Consulate.

The American Minister or Consul, unlike our own, is not so armour-plated with exclusiveness and dignity that he cannot bend to help on the commerce of his country. He is strenuously energetic in ferretting out commercial possibilities, and in keeping his countrymen posted thereon. He is always and easily accessible, receives his national cordially, and on terms of equality so far as the business in hand is concerned. The American accepts or offers a cigar, tells who he is and what he wants and why, and incidentally allows the official to perceive that it will be to the interests of all concerned if the scheme is put through. If it be "bunkum," it is pretty certain that the drummer will be abruptly told so and his departure perhaps assisted, but if it will bring credit to the United States, the Consul vigorously applies his influence and leaves no stone unturned to bring the business to a successful issue. The high authorities and the Press at home are promptly informed that America has scored another success against all competitors, the native is enriched, the American firmly established in the country, the United States gets work and profit, and by the time his term expires the chances are that the official, whose salary will perhaps just pay for his board and lodging, has made that little pile which he came out with the intention of making.

If we would acquire new fields for commerce, or keep what we have, drastic changes must be effected in the working and constitution of our Consulates abroad. Such changes should embrace as much of the methods of our American cousins as would be acceptable to the natives and in harmony with our own ideas of commercial fair play and morality. All the rest of our system, with its life-long service and pension retirement, promotion by seniority without reference to commercial fitness, the restraint of diplomatic influences, the meretricious dignity of exclusiveness and inertia with its puerile sword and gorgeous uniform, and all the rest of its antiquated and useless red-tape machinery, should be at once consigned to the scrap heap of the "has-beens," and replaced by a well-thought-out and liberal programme of consular duties, which, whilst allowing a Consul entire freedom of action, should stringently exact that enlightened and vigorous effort which the promotion of our commerce and the protection of our merchants and traders so urgently demand, the absence of which under present methods justifies the oft-heard lament of the Britisher abroad that he "has no use for his Consul."

ELECTRICAL LEGISLATION AND THE INSTITUTION OF ELECTRICAL ENGINEERS.

Before dealing with the evidence taken by the Committee, it is of interest to consider the constitution of that body and the points they decided upon for the opinion of the witnesses invited to submit their views. The gentlemen selected to form the Committee consisted of the following, viz. :—

Prof. W. E. Ayrton, F.R.S.	Mr. W. M. Mordey.
Major P. Cardew, R.E.	Prof. J. Perry, F.R.S. (President).
Lieut.-Col. R. E. Crompton.	Mr. R. P. Sellon.
Mr. S. Z. de Ferranti.	Mr. A. Siemens.
Mr. Robert Hammond.	Mr. C. P. Sparks.
Mr. H. Hirst.	Mr. J. Swinburne.
Mr. J. E. Kingsbury.	Mr. A. A. C. Swinton.
Mr. W. L. Madgen.	Prof. Silvanus P. Thompson, F.R.S.

Five of the members did not attend any of the seven meetings devoted to taking evidence, viz., Prof. Ayrton, Messrs. Hammond, Hirst, Swinburne, and Prof. Silvanus P. Thompson. No explanation is given of their absence, but it must be assumed that they are not responsible for the decision ultimately arrived at, nor did they contribute in any way to the elucidation of the important questions that were dealt with.

It would have been interesting if Mr. Hammond had expressed his views on the resolution adopted by the Committee which attributes to "*the powers of obstruction granted to local authorities*" the backwardness of the industry in this country, and the recommendation that the Electric Lighting and Tramway Acts should be amended in so far as they enable local authorities to veto or delay the carrying-out of electric supply and traction projects.

The Committee had the advantage of the attendance of the new President, Mr. W. Langdon, who acted as chairman at the last four meetings.

The evidence was given in the form of written statements by Messrs. Madgen, Crompton, Langdon, Ivey, Pearson, Swinton, Dr. Spence Watson, Messrs. P. Dawson, and J. Clifton Robinson, supplemented in most cases by verbal replies to questions from the Committee, the *viva voce* examination often consisting of leading questions tantamount to evidence by the interrogator; especially was this the case in the queries by Messrs. Kingsbury, Sparks, Mordey, Siemens, Langdon, and Prof. Perry.

At the second meeting of the Committee, held on April 29th, 1901, the points for the consideration of witnesses were agreed upon—the programme was suggested by Mr. Madgen—and adopted as follows :—

Note of Points for the Consideration of Witnesses.

1. As to whether the electrical industry in the United Kingdom is in a backward condition as compared with other countries, and, if so, in what respects, and due to what causes.

2. As to the practical economy and public advantage of electrical power supply undertakings and of electrical traction undertakings dealing with areas of suitable character in regard to size, distribution of population and of trade, but without reference to local government boundaries.

3. As to the effect such undertakings are likely to have upon over-crowding difficulties in congested centres of trade.

4. Concerning the present state of legislation relating to the electrical industry, and as to the amendments which are desirable in the interests of the general community and of the manufacturing trades of the country. Reference to Acts, Reports, &c. :—

(*a*) Electric Lighting Acts, 1882—8. Section I. Notwithstanding anything in the Electric Lighting Act, 1882, no provisional order authorising the supply of electricity by any within the district of any local authority shall be granted by the Board of Trade except with the consent of such local authority, unless the Board of Trade in any case in which the consent of such local authority is refused are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with, and in such case they shall make a special report, stating the grounds upon which they have dispensed with such consent.

(*b*) Report of Joint Select Committee of Parliament, 1898, appointed to consider and report upon a reference in regard to "Electrical Energy—Generating Stations and Supply." Extract from Committee's report—

"Where sufficient public advantage is shown, powers may be given for the supply of electrical energy over an area including districts of numerous local authorities, and involving plant of exceptional dimensions and high voltage. The Committee further think that undertakings of this character may properly be authorised on conditions differing in some respects from those imposed by and under the existing Acts.

"The Committee consider that the provisions of the Electric Lighting Act, 1888, which require the consent of the local authority as a condition precedent to the granting of a provisional order, should be amended. In their opinion the local authority should be entitled to be heard before the Board of Trade, but should not have, so to speak, a provisional veto, only to be dispensed with in special cases by the Board of Trade."

(*c*) The Tramway Act, 1870, particularly sections in regard to "consent," "frontagers," and "purchase."

(*d*) The Light Railway Act in relation to the compulsory purchase section of the Land Clauses Act, running powers, competitive lines, &c.

(*e*) The Parliamentary Standing Orders, in relation to special Acts for tramways. No. 22 requires consent of local authorities as a condition precedent to such an Act being considered on its merits.

5. As to changes desirable in procedure with a view to reducing the time occupied and expense incurred in obtaining authority to carry out electrical undertakings.

6. As to the most suitable arrangement under which the scientific and practical knowledge of the Institution can be placed at the service of the Board of Trade so as to ensure questions concerning rules, regulations, and other administrative matters of a diverse character, being dealt with in the best-informed manner.

7. As to the most promising means of giving effect to their recommendations.

With this programme to guide them, the witnesses invited for the purpose (who might have been multiplied with advantage, especially from among the commercial pioneers of the industry) prepared their statements, Mr. Madgen leading off by proving instances of the checks resulting from

legislative restrictions and the obstructions of local authorities.

Under the first head he referred to the purchase clause under the Act of 1882 being commercially impossible and preventing capital from being obtained. He contended that during the interval between 1882 and 1888 America and Germany obtained a lead, and now hold the bulk of the electrical export trade. He instanced the baneful influence of the power given to local authorities to refuse assent to powers being granted to companies and their taking provisional orders themselves really for blocking purposes, and he gave numerous instances to prove that much of the opposition was made in the gas interest.

He was severe upon the *quasi* officials of local authorities and their associates, to whose direct monetary advantage was due opposition to every project in which they are not employed. He also directed attention to the enormous waste of time, energy, and capital involved in pushing electric tramway systems, owing to the legislative restrictions, and considered that the framing of the purchase clauses in the Act of 1882 was due to Mr. Chamberlain, who was instrumental in carrying out the municipalisation of gas supply in Birmingham, having formed the opinion that the goodwill of an electric light undertaking would be, as Lieut.-Col. Crompton put it in his question to Mr. Madgen, "a gold mine," and so he excluded it in framing the purchase clause.

The legislation complained of, according to Lieut.-Col. Crompton, was due in great measure to the wild statements of Edison that gas would be superseded in a year or two, and such overstatements by certain electrical men led to that "greedy legislation."

Then, said the gallant lieutenant-colonel, "local authorities rushed for orders," and finding that it was not an easy matter to carry them out, let them lie in abeyance. They would not let other people touch them, and so the whole business of the electric lighting work of Great Britain was tremendously retarded.

Then Mr. Madgen was reminded by his questioner of the pioneering work of the Grosvenor Gallery Company, the Kensington Company, and others, which attracted investors, and a real start was made.

The position of the town clerks was brought out by one of Lieut.-Col. Crompton's questions, many of which were framed, as we have stated, much in the form of direct evidence from himself, which he asked the witness to confirm. "Is it not the case," said Lieut.-Col. Crompton, "that the town clerk, in many cases, acts as solicitor to the Bill for his town, and does he not benefit both ways, *by opposing an order, and by his town obtaining one?*" and Mr. Madgen replied that: "In most cases the town clerk gets an inclusive salary." His remarks had applied to clerks to Urban District Councils and to Rural District Councils (the larger proportion of local authorities), but he thought that the town clerk of a large city would not benefit one way or the other.

A naughty question of Lieut.-Col. Crompton's was very suggestive and pertinent, when he asked if it has ever been whispered in the profession that town clerks sometimes share the Parliamentary agent's fees? and Mr. Madgen replied: "Yes, it is the practice of some Parliamentary agents to rebate one-third of their fees to the town clerks."

Another inducement to town clerks to encourage municipal enterprises and trading was pointed out in the practice of fixing the salary according to the magnitude of the various undertakings with which the city deals, and that if the town have large schemes, whether of gas, water, sewerage, or electric light, the town clerk gets an increase of salary pretty nearly in proportion to the expenditure of the town; Mr. Madgen presumed in reply that he would either get it in fees or in salary.

Here is a hard nut for the Municipal Association to crack, and we shall no doubt have their reply on behalf of the class for whom some think that the Association is a *town clerk's trade union.*

(*To be continued.*)

Willesden.—The Polytechnic Institute is to be lighted electrically, to the specifications of Mr. F. H. Taylor, consulting engineer.

LIGHT RAILWAYS AND LAND DEVELOPMENT.

By J. M. HEWITT and W. G. RHODES, M.Sc., M.I.E.E., Consulting Engineers, Manchester.

The keen and ever-increasing competition, both in home and foreign markets, from which the industries of this country are suffering, has of late been repeatedly impressed upon us, and the interest taken by the general public in the matter is shown by the fact that almost every daily paper contains some reference to the subject. This competition, however, has not been an unmixed evil, as our manufacturers have profited by the lessons taught them, and are now endeavouring, not unsuccessfully, to make up lost ground by adopting modern methods and modern machinery.

Difficult as success has been, and doubtless will be, where our industries are concerned, there are still greater difficulties to be overcome before the agriculture of this country can be placed on a satisfactory basis, and worked on profitable lines; our competitors are spread over a large area; they are closer to our doors, and are equipped with a means of transport which enables them to place their products on our markets at a smaller cost than we ourselves can do.

Much has been said and written in a pessimistic vein regarding our position in the manufacturing world, but it would be difficult to be optimistic with regard to the position of our agriculturists while the land of this country is gradually going out of cultivation, and the agricultural population, which should be the backbone of the nation, is steadily migrating to the towns, where it rapidly deteriorates, mentally, morally, and physically.

If any remedy for this state of affairs can be found, and one which will rather have the effect of migration from town to country, the whole population, industrial and agricultural alike, will benefit enormously; any such improvements must, however, be preceded by a complete change in our methods, and by a more enterprising spirit on the part of our landowners and farmers, who should follow the example of our manufacturers by adopting the points in foreign systems which are superior to their own.

The cost of railway carriage in this country for agricultural produce is one of our chief difficulties in successfully competing with foreign rivals, and, although the Light Railway Act of 1896 was passed with the intention of giving facilities for the transport of the products of the land to a ready market, the Act has been more used for the purpose of promoting light railways in populous districts for the sake of passenger traffic.

The proper field for the exploitation of light railways has been almost entirely neglected, and, as a consequence, neither our agriculture nor our fisheries have benefited by the Act as was intended.

It has been imagined that it is only possible to make light railways pay in populous districts, notwithstanding the fact that railways of this kind on the Continent not only earn fair dividends, but also have promoted the interests of agriculture and trade, and increased the value of the land adjoining them.

Being interested in a railway to be constructed in this country, where the goods traffic is likely to exceed the passenger traffic, and where the conditions resemble those prevalent on the Continent, we desired to make ourselves thoroughly conversant with the methods adopted in Belgium, where there is a very complete network of light railways. We, therefore, asked M. C. De Burlet to grant us permission to examine the light lines constructed by the Belgian National Light Railway Company, of which he is the managing director. This permission was most cordially given, and he was good enough to depute M. Paul Berger, one of his engineers, to accompany us over portions of their light railways.

The information which we have obtained is of the greatest value in furnishing illustrations of commercially successful light lines running through sparsely populated districts, and depending for traffic chiefly upon agricultural products and manufactured goods, and it is of national importance to realise that similar methods of dealing with the natural wealth of the land should be adopted in our own country.

There are at present in Belgium, which is only half as

large again as Wales, 1,234 miles of light railways already in operation, 416 miles in course of construction, which are laid at the rate of about 100 miles per annum, and an additional 1,320 miles to be constructed. When this mileage is completed, there will be 1 mile of light railway to every 3·84 square miles of land.

In Belgium, the lines are usually single lines with turnouts, with varying gauges, the cost per mile, including rolling stock, varying from £1,300 to £9,000. Sidings are taken into farmyards and factories, the latter often manufacturing chemical manures, which the farmers on the route can receive direct from the manufacturer at the small cost for carriage of 1½d. per ton per mile.

Agricultural produce varies in cost of carriage according as it is conveyed in closed or open wagons, the cost per ton per mile being 2·32d. when closed wagons are used, and 1·7d., or less, where the goods can be transported in open wagons, with an addition in each case of 4·9d. per ton whatever the distance carried.

Passenger fares are equally low, first-class fares being about 1¼d. per mile, and second-class fares about $\frac{9}{10}$d. per mile, while weekly tickets are issued to labourers and school children at half the usual rates.

The travelling facilities given by the light railways have increased the traffic between village and town or village and village; for instance, the passenger receipts on the Antwerp-Hoogstraeten-Turnhout line which were, in 1887, the first year of working, £8,893, were, in the year 1901, £12,365, an increase of 40 per cent. after a period of 14 years. The receipts from goods traffic on the same line were £1,692 in the year 1887, and £6,697 in 1901, an increase of 296 per cent. in 14 years. The capital outlay on this line was £103,311, and the working expenses in 1901 were £12,147, leaving a dividend of 6·7 per cent. on the outlay.

The line is 33¼ miles long, and passes from Antwerp through the towns and villages of Borgerhont, Deurne, Wyneghen, Schilde, Westmalle, Oostmalle, Ryckevorsel, Hoogstraeten, Vlimmeren, Vosselaer, Beerse, and Turnhout. The aggregate population of these places increased from 62,521 in the year 1885 to 80,405 in 1897, an increase of 29 per cent. in 12 years, while some of the smaller villages nearly doubled their population; for example, in 1885 the population of Vosselaer was 1,109, whereas in 1897 it had increased to 2,022.

There are several sidings on this line which are of great use to the owners, inasmuch as the cartage of goods is thereby obviated. The number of these sidings increases as the places grow, and the traffic requires them.

The bulk of the material carried on this railway is agricultural produce, and milk, eggs, butter, &c., are put straight into the wagons by the farmer in a siding in the farmyard. There is thus no cartage to pay; the goods are often delivered direct to the consumer's door by the light railway, and, in consequence, the prices charged are correspondingly low. The produce for export is taken to a main line station for transport to the coast, often for shipment to England.

The light railways in Belgium do not enter into competition with the main lines of railways; they communicate with the smaller villages, and bring their passengers and goods into a large centre on a main line of railway. The main lines are thus allowed to do their proper work without competition with the more cheaply constructed light lines. There is, therefore, the best feeling existing between the two railways, since the light railways act as feeders to the main lines, and increase both their passenger and goods traffic.

The first of these light railways was started in 1885, before electricity was in common use for traction purposes, and consequently the majority of them are steam railways, only about 45 miles being worked electrically; on these, however, the ratio of the working expenses to the receipts is less than on the steam lines.

The light railways run, for the most part, on the sides of the main roads, only about 25 per cent. of their total length being on land of their own. They almost entirely consist of single lines with long loops in the villages, at each of which the trains stop to pick up and set down passengers, or to release or take up goods wagons. In each village a shop forms a combined station, waiting, and refreshment room, where passengers can await the arrival of a train. There are no booking offices; the conductor of the train gives the tickets and collects the fares as is done in tramcars in England. Neither are there any railway officials at the stations except at termini, where there are sheds in which the coaches and locomotives are kept when not in use.

One effect of the light railways is to keep the agricultural labourers in the villages, where there are advantages which they could not enjoy if they were compelled to reside near their work. They are enabled to live a few miles from their occupation without any disadvantage or drawback, and their children can attend the village school or go by train to a neighbouring town and obtain an education which would otherwise be impossible.

The effect of the light railways on the value of land and property is very pronounced, always increasing it, sometimes to more than ten-fold its original value. As the villages grow the adjacent land becomes necessary for building upon, and commands a much higher price than it would as arable land. In some cases brickyards have appeared in places where, prior to the existence of the light railway, the cost of cartage would have been so great as to preclude the manufacture of bricks, and the land has consequently increased in price from £3—£16 per acre to £8—£120 per acre. On every side the advantages of the railways are evident, and their receipts are constantly increasing. Buying and selling the produce of the land and manufactured articles is rendered easier. Farmers and their wives can proceed to market by rail, taking eggs, butter, or any light articles for sale on payment of their passenger fare only, and bring back such small purchases as they may desire to make.

Prior to the establishment of light railways in Belgium, the country people had either to walk or to proceed by mail coach from one place to another, the main lines not, as a rule, passing through, or having stations at, the small villages, but only connecting comparatively large towns. The carriage of goods was, therefore, very costly, and often so great, as to absolutely prevent the cultivation of agricultural products for sale elsewhere; but under the improved *régime* the farmers eagerly cultivate every square yard of land, knowing that they can find an accessible and ready market for all their produce.

The service of trains is arranged to meet the requirements of the traffic, early morning trains running for the purpose of carrying goods to market and labourers to their work, and in the evening after the hours of labour. A few trains run at intermediate times for the convenience of the less occupied public, and to carry any goods which can be dealt with during the day.

It is interesting to note the proportion of the receipts contributed respectively by passenger and goods traffic. Taking the Antwerp—Hoogstraeten—Turnhout line in the year 1901 the passenger receipts were £12,365 and the goods receipts £6,697, or passenger receipts were 64 per cent. and goods 36 per cent. of the total receipts.

In the same year, 1901, the total receipts on the line from Sprimont to Poulseur were £5,056, of which £681 were passenger and £4,375 were goods receipts; that is, the goods receipts were 86·5 per cent. of the whole, the remaining 13·5 per cent. being from passenger traffic.

This last example particularly emphasises the benefit conferred upon the district and its industries.

There are several stone quarries between Spirmont and Poulseur which, prior to the opening of the light railway, were but little worked, owing to the fact that cartage cost 6½d. per ton per mile, whereas the light railway charges only 1¾d. The effect of this reduction has been to increase the goods receipts from £959 in 1888, the first year of working the line, to £4,375 in 1901, an increase of 456 per cent. in 14 years. In the case of this line the gauge is 4 ft. 8½ in., which is the standard, and wagons exchanged with main lines run over it without transhipment.

The total cost of construction of this line, which is 5¼ miles long, was £27,154. The working expenses for the year 1901 were £2,872, leaving £2,184 available for dividend, and returning 8 per cent. on the capital outlay.

Between Poulseur and Spirmont there are five trains per day each way between the hours of 6 a.m. and 6 p.m. The first-class fare for the whole distance is 6d. and the second-class 4d.

Another instance of an agricultural line is that connecting Wavre and Jodoignes and passing *en route* through the

villages of Gastuche, Archnnes, Grez Doiceau, Longueville, Roux Miroir, and Incourt; its length is 16 miles, and it cost £65,870 to construct. The receipts in 1901 were, passenger traffic £4,036, goods traffic £2,870.

Wavre is a market town of about 6,000 inhabitants, and there is a large weekly influx of farmers from the surrounding country with their produce and live stock for sale. Amongst the sidings connected with this line is one running to a chemical manure factory, which supplies the neighbouring farms.

Like other Belgian light railways, this line runs for the most part along the side of the high road, where the district derives the benefit, not only of having a service of trains passing close to the houses, but of the repairing of the roads between the rails and between the tracks, together with two strips 2 ft. wide outside the rails, which is done by the light railway company.

(To be concluded.)

NEW PATENTS AND ABSTRACTS OF PUBLISHED SPECIFICATIONS.

NEW PATENTS, 1902.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London W.C., and at Liverpool, to whom all inquiries should be addressed.

9,780. "An improved fitting for electric incandescent lamps." J. Kremenezky. April 28th.

9,788. "Improvements in electric switches and in the application of the same to electrically-propelled vehicles." W. M. Brown. April 28th. (Complete.)

9,789. "Improvements relating to electric railway systems and more particularly to crossings and switches for the same." H. E. Keeler. April 28th. (Complete.)

9,800. "Improvements in switch or ringing keys for telephone switchboards." L. M. Ericsson. April 28th. (Complete.)

9,801. "Improvements in telephone jack-trips." L. M. Ericsson. April 28th. (Complete.)

9,803. "Improvements in and relating to the electrolytic decomposition of alkaline salts." M. Wildermann. April 28th. (Complete.)

9,812. "Improvements in the electrolytic production of a bleaching liquor and caustic alkali lye and in apparatus employed therein." A. J. Boult. (H. Seibert and G. Temple, Germany.) April 28th. (Complete.)

9,815. "Improvements in and connected with the prevention of sparking on the interruption of ethereal telegraphic and other electric circuits." W. L. Wise. (K. Birkeland, Norway.) April 29th.

9,825. "Improvements in, or relating to, electric fuse-boxes for street mains and analogous uses." R. F. Hall. April 29th.

9,849. "Improved means or method of connecting incandescent electric lamps in festoons, and for other like temporary uses." W. Barker. April 29th. (Complete.)

9,859. "Improvements in implements for stripping insulation from wire." C. C. Silbey. April 29th.

9,873. "Improvements in and relating to the connections or joints of cables for conveying electrical energy." A. G. Brookes. (H. G. Thompson, United States.) April 29th.

9,899. "Improvements in apparatus for making aerated beverages and automatically and electrically controlling the gas pressure therein." P. E. Malmstrom. April 29th. (Complete.)

9,946. "An improved telephone call list." M. Michaelis. April 30th. (Complete.)

9,947. "Improvements in an electric low water alarm." C. A. Allison. (A. Graham, United States.) April 30th. (Complete.)

9,949. "Improved means and apparatus for effecting telephonic intercommunication." J. Young. April 30th.

9,956. "Improvements relating to telephone receivers, audiphones and the like." H. H. Lake. (Akouphone Manufacturing Company, United States.) April 30th. (Complete.)

9,977. "Improvements in pole-pieces for dynamo-electric machines." The British Thomson-Houston Company, Limited. (A. Churchward, United States.) April 30th. (Complete.)

9,978. "Improvements in pole-shoes for dynamo-electric machines." The British Thomson-Houston Company, Limited. (A. Churchward, United States.) April 30th. (Complete.)

9,983. "Improvements relating to current collecting devices for electric traction systems." E. Bede and A. A. Condamin. April 30th.

10,000. "Improvements in electrical resistances." A. H. Mayes. May 1st.

10,068. "Improvements in intercommunication telephones." G. E. Beckett. May 1st.

10,083. "A new or improved method for producing electric insulating bodies." H. J. Haddan. (The "Pyrisolith" Isolating Material Manufacturing Company, Limited.) May 1st. (Complete.)

10,097. "Improvements in conduits for electric mains and in the jointing of same." L. Barlow and J. Joung. May 2nd. (Complete.)

10,098. "Improvements in starting switches for electric motors." T. E. Weaver May 2nd.

10,102. "Improvements in or relating to apparatus for use in electro-plating." F. T. Jackson. May 2nd.

10,141. "Improved fuse holders for electric current." J. J. Rawlings, W. R. Rawlings, and Rawlings Bros., Limited. May 2nd.

10,181. "Improvements in syntonic space telegraphy." O. J. Lodge and A. Muirhead. May 2nd.

10,185. "Means for removing moisture from electric conductor conduits." I. Shone and E. Ault. May 2nd.

10,189. "Improvements in and relating to electric incandescent lamps, and to means for connecting the same in the electric circuits." A. L. Lean. May 2nd.

10,198. "Improvements in collectors for use in connection with overhead electric traction systems." H. Peace. May 3rd.

10,204. "Improvements in electrodes." J. Hargreaves, J. W. Stubbs and J. Kearsley. May 3rd.

10,205. "Improvements relating to electrical fire alarms and other electrical signalling systems, telegraphy, telephony, wireless telegraphy, and the like." E. G. Pulford. May 3rd.

10,231. "Improvements in and relating to high speed electrical generators and motors." S. Z. de Ferranti. May 3rd.

10,237. "Improvements in phase indicators." K. E. E. Everett and F. Pung. May 3rd.

10,245. "Improvements in receivers suitable for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Company, Limited. May 3rd.

10,246. "Improvements in receivers suitable for wireless telegraphy." G. Marconi and Marconi's Wireless Telegraph Company, Limited. May 3 d.

10,262. "Improvements in and relating to arrangements for controlling automatic electric regulators, cell switches, and the like." W. E. Evans. (Allgemeine Elektricitäts Gesellschaft, Germany.) May 3rd. (Complete.)

PATENTS EXPIRING.

We are informed by Messrs. W. P. Thompson & Co., that in the year 1888, 428 complete specifications were filed. Of those that bear the date April, May and June, only nine were maintained to run their full term, and, being of considerable interest, we give short abstracts of them below:—

6,481. "Improvements relating to the electrical transmission of power and to apparatus therefor." H. H. Lake. Dated May 1st, 1888. Armatures, field magnets, commutators, motors, regulating speed of.—Relates to the transmission of energy by using electro motors with two or more independent circuits connected up to separate circuits on the armature of an alternating-current generator. 8 claims.

7,846. "Improvements in or relating to indicators for alternating electric currents." W. P. Thompson. Dated May 29th, 1888. Current meters.—Relates to apparatus for measuring at a central station the difference of potential on the work circuit, and consists in introducing into the voltmeter circuit an opposing electromotive force proportional to the current supplied to the work circuit, and cannot be well described without reference to a diagram. 11 claims.

7,849. "Improvements in or relating to apparatus for detecting and locating faults in alternate current electric circuits." W. P. Thompson. Dated May 29th, 1888. Testing.—Relates to apparatus for detecting and locating faults in alternating current electric circuits. The primary coils of two converters are connected to the leads and to the earth by means of a conductor. The secondary circuits contain indicators such as incandescent electric lamps. If one of the leads is earth-connected, one of the converters will be shunted, while the strength of the current passing through the second converter will be increased. An alteration in the light emitted by the lamps will thus take place and indicate in which of the leads the fault occurs. 3 claims.

6,502. "Improvements relating to the generation and distribution of electric currents and to apparatus therefor." H. H. Lake. Dated May 1st, 1888. Transformers, distributing.—Relates to special means for transforming electric currents for distributing purposes. The transformer consists of a core closing on itself, i.e., ring-shaped, cylindrical, or of similar form, which may be laminated. This coil is wound with a certain number of pairs of coils, which correspond to the number of coils on the armature of the alternating dynamo. 4 claims.

6,961. "Improvements in automatic electric batteries." G. A. Nussbaum. Dated May 10th, 1888. Induction coils.—Relates to coin-freed apparatus for giving electric shocks. An induction coil has its secondary coil connected to sliding handles by means of contact springs, the strength of the shock being increased by pulling out the handles. 4 claims.

7,850. "Improvements in or relating to alternate current electric distribution." W. P. Thompson. Dated May 29th, 1888. Distributing.—Consists in arranging two or more incandescent lamps or other translating devices in series, each lamp or device being shunted by a reactive coil, which is so proportioned as to offer a high resistance to the passage of the current when the lamp is in operation, but the reaction of which, when the lamp is disconnected, effects a resistance approximately equal to that of the lamp. 1 claim.

7,851. "Improvements in switches for electric circuits." W. P. Thompson. Dated May 29th, 1888. Switches; cut-outs.—Relates to switches for use with dynamos giving high potential, and is too long for purposes of abridgment. 3 claims.

7,852. "Improvements in or relating to central station apparatus for system of electric distribution by alternate currents." W. P. Thompson (G. Westinghouse). Dated May 29th, 1888. Distributing switches.—Relates to central station apparatus, and consists in the combination of several independent alternating-current dynamos, the field magnets of which are excited by separate dynamos; with switches connecting them with the main leads, which by switches are connected to the external circuits. Ammeters and voltmeters are suitably introduced. 10 claims.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson and Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d (in stamps).

1900.

5,154. "Improvements in electric traction on a conduit system." S. G. Bennett. Dated March 19th, 1900. Relates to electric railways and tramways on a conduit system. A long flexible collector bar runs in the slotted conduit, and is carried by arms from the bogies at each end of the vehicle. The arms are mounted on a pin on a bracket which works on a second pin, and is provided with horns to embrace an arm projecting from the vehicle. A spring and guards may be provided. The collector passes between contact pieces pivoted on standards or on brackets in boxes placed at intervals in the conduit. These pieces are pressed together by springs or by weights, and have insulated rubbing pieces on their faces, one of them being connected by the feeder to the main. The rubbing pieces may be hinged on their arms so as to have a parallel bearing on the collector.

5,167. "An automatic telephone call recorder." A. E. Lamkin. Dated March 19th, 1900. Relates to apparatus for recording the number of calls in a telephone system, and for deleting or nullifying by the exchange the number of any call which is not completed. There is a wheel of a counter which is operated one step by a pawl each time that the telephone is taken off the hook. The counter may be turned back by another pawl operated by an electro-magnet in the circuit connected with the exchange.

5,181. "Improvements in electric heating systems for cars." Westinghouse Brake Company, Limited. (*F. C. Newell.*) Dated March 19th, 1900. Heating: In electric cars the current generated by the motors in the local braking circuit can be employed for heating purposes.

5 232. "Improvements in storage batteries." P. Kennedy. Dated March 20th, 1900. Relates to a support for the active material. 3 claims.

5,274. "Improved apparatus for the electro-deposition of metals." W. Y. Buck. Dated March 20th, 1900. Work holders for spoons, forks, and the like are formed in such a way that the metal, such as silver, is unequally deposited, being deposited more heavily upon the parts which receive most wear. 4 claims.